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LIBRARY OF CONGRESS NOV 1 1915 SMITHSONIAN DEPOSIT

A YEAR'S DEVELOPMENT IN LIGHTING.

From the Report of the Committee on Progress—Illuminating Engineering Society.

Gas Lamps and Appurtenances.

Burners.—A very important development in incandescent gas lighting is, the recent introduction of an upright unit fitted with three miniature mantles in soft form and made from artificial cellulose fiber. This type of lamp operates well over a reasonable range of gas pressure and qualities, is efficient and requires no enclosing draught-inducing cyclinders. It can replace open flame burners without glassware change on present fixtures, and furnishes a means of obtaining semi-indirect or indirect illumination.

Several new types of inverted burners, with inclined chute-like heat baffles to divert the products of combustion away from the fixtures, have been worked out in sizes giving approximately 100, 150 and 250 horizontal candle power. These units are furnished with non-tarnishable, heat-resisting lacquer, and are so constructed that the heat discharge vents are completely hidden. Being entirely of metal, they can be finished to match the fixture on which they are to be used. The gas lamp designed to take advantage of the fact that, the hottest part of the flame from a meeker or inverted Bunsen burner is in the neighborhood of the small green inner cones and mentioned in last year's report, has been in use in Germany, and proved the prediction of unusual sturdiness and long life.

An elaborate study of the room ventilating action of various types of gas burners has been made in England. The results show that the ventilating efficiency is greatest for upright burners; that of the inverted burners, those giving a clear passage for the gases had the greatest ventilating efficiency; that the addition of deflectors intended to protect the fittings from the action of the gases reduced the ventilating efficiency by as much as 9%. Experiments made in this country, however, show that when the stack is properly designed, higher efficiencies are obtained with deflectors due to a superheating of the mixture before burning. Globes with a very open base had no effect on the ventilating efficiency, but those with a constricted opening produced a reduction dependent on the area of that opening.

To produce the best results with gas for lighting, the character of the Bunsen flame used in conjunction with gas mantles must not change materially. In order to ascertain how closely service is maintaining constancy of burner conditions, a gauge has been developed consisting of a small, slender upright Bunsen tube of exact design and carefully drilled orifice, mounted on a base with a pressure gauge. A scale is placed at the side of the Bunsen tube on which to note the length of the inner cone, and any variation of the cone length can be easily seen. The gauge is not calibrated to indicate any specific quality of gas, but will show only those changes that effect Bunsen burner service.

Despite the long life and high efficiency of the present day gas mantle, efforts are still being made to strengthen the structure, and to intensify the illuminating power by the application of some solution after the mantle has been purchased. Such efforts have not yet been very successful.

Whether illuminating gases cause the fading of colors in fabrics has been made the subject of careful test. It was found that the deterioration of color either due to temperature, illumination, or the products of combustion arising from the use of gas lighting is of no practical importance compared with the effect of daylight.

Automatic Lighters.—The protected pilot tip, so successfully applied to outdoor gas arc lamps has been modified for use on indoor burners, reducing the pilot flame outages. A simple electric cock for distance control of gas burners has been produced. In Florence, Italy, a system of distance control for gas lighting has been in satisfactory use for 3 years. As a result of a recent successful test by military authorities, in which the city gas was shut off at a specified time and relighted after a predetermined period, it is expected that the system will shortly be employed in Italian frontier and coast towns. In general, inventors are looking toward means for making distance lighting by pressure waves selective.

Artificial daylight units using gas have been developed; and also units designed for photographic work, which will be mentioned later.

Heating Value.—The use of the calorific standard for gas in place of the candle power standard is increasing in this country. In many localities both standards are still required, but it seems to be a quite general experience that if the gas is maintained at the right calorific value, the candle power value will be satisfactory. At the 1914 convention of the American Gas Institute, there was referred to the Board of Directors the question of adopting the Metropolitan No. 2 (Carpenter Argand) burner as the standard burner in the determination of gas candle power. It has been suggested by the Bureau of Standards that "for those places where a candle power specification is necessary in order to afford protection to users of open-flame lights, * * * an open-flame burner should be used in testing the gas candle power." As the number of open-flame burners used in this country is relatively small the advisability of adopting this suggestion has been seriously questioned. The Bureau also suggests that the adoption of any standard burner might delay the present tendency toward the adoption of heating value standards.

Data have been given of experiments that indicate that calorific value, specific gravity, and gas candle power do not definitely specify a gas for commercial purposes. Gases which are identical in these properties may yet differ so in composition that the resultant flame temperatures will differ greatly, and hence the performance of incandescent lighting appliances cannot be predetermined on this basis. It has been found, however, that heating values above 600 B. T. U, are not desirable for incandescent gas lighting.

A method has been devised to enable a gas company to determine the candle power of coal gas produced at night as well as by day. A holder, 3 feet in diameter and 3 feet high is used and the flow of gas into it is regulated so that it will just fill up during the night or during the day. Tests made on the candle power of the gas collected in the holder agreed exactly with those made according to the "periodic method," in which readings are taken periodically when the candle power is at a maximum, at a minimum and at the average.

Electric Incandescent Lamps.

Gas-Filled Tungsten Lamps.—While the development of the tungsten filament electric incandescent lamp has been fairly rapid, as compared with that of the carbon filament type, it would seem as if the progress each year was greater than that of the previous

year, and that salesmen would hardly have time to dispose of one product before an improved successor was available.

In the year's report, reference was made to the sizes of non-vacuum gas-filled tungsten lamps then available, 400 being the lowest wattage for multiple burning; now 100, 200 and 300-watt sizes are made, and in May all sizes from 200 to 1,000 watts for circuits of 220 to 250 volts were put on the market. In England 60-watt lamps of this type were announced July 1. In the 60-watt and 100-watt lamps argon gas is used instead of nitrogen. In Germany for 100 to 130-volt circuits, 40 and 60-watt sizes, and for 200 to 250-volt circuits, 75 and 100-watt sizes were advertised at about that time.

Physics.—Tests to determine the effect of winding the filament in the form of a spiral, indicated no marked difference in the quality of light, from the straight and spiralled filaments of tungsten in an the atmosphere of nitrogen. When the luminous efficiency (ratio of the "visible" to the total amount of radiation emitted) of these two types was practically the same, the candle-per-watt ou'put was found to be 15 to 20% higher in the spiralled filament, owing to the lessening of convection losses. When the straight filament was operating at about 0.5 watt per candle and the spiralled filament operated so that the outside surface of a turn was set to the same emissivity as that of the straight filament, the spectral energy curves of the two showed that the spiralled filament emitted about 7% more infra-red energy than the straight filament. Hence the luminous efficiency of the latter under the given conditions was 7% higher than the former.

Experiments showed that the 'stationary" film of gas about the filament of a gas-filled lamp does not cling to the filament, but moves upward along it.

Vacuum Tungsten Lamps.—Since last year's report there has been an increase in the efficiency of the vacuum tungsten lamp of from 7 to 10% in sizes below 150 watts. In July, a sign lamp for multiple circuits, 105 to 125 volts was announced using 7.5 watts and giving 5-candle power; the smallest wattage, standard lighting circuit lamp yet manufactured. The practice of introducing chemicals to delay the discoloration of the bulb, has been extended to include the 10, 15 and 20-watt sizes, and has permitted the operation of all vacuum lamps at higher efficiencies. The spiral winding in a concentrated form is now used in the 25, 40 and 60-watt sizes, in addition to previous sizes. The lamps use the same size bulbs and have the same averaged mean spherical efficiencies as the regular type of the same wattage, but have a somewhat short-life.

The completeness with which the gas-filled street series lamps have superseded the vacuum type has resulted in the withdrawal of these vacuum lamps from the listed lamp schedules.

The tantalum lamp has disappeared from the market, and is being rapidly followed by the carbon lamp. In miniature lamps, the tungsten filament has so completely replaced carbon that they comprise over 85% of the total of miniature lamps sold.

Rating.—It has become the almost universal custom in this country to rate filament lamps according to their watts input, and apparently this has served to raise the prevailing standard of illumination. In England, however, a discussion before the British Illuminating Engineering Society, shows that this method of rating is by no means generally accepted as satisfactory. The preponderance of opinion seemed to be in favor of some form of candle power rating, with a difference of opinion as to whether the unit should be the mean spherical candle or the lumen. In Germany, the subject has been considered at a series of conferences of lamp manufacturers, who proposed the continuance of the voltage-wattage rating. The lighting committee of the German Association of Electrical Engineers discussed the proposal, but could come to no full agreement. A representative from the Associations of Central Stations urged that it should be required by law to state the voltage, the upper and lower hemispherical candle power, the total watts consumed and the watts per candle.

Physics.—The disappearance of a gas introduced at low pressure into a bulb containing an incandescent tungsten filament has been investigated, and it has been found that four classes of reaction are involved. The filament is directly affected by the gas; or the gas reacts with the vapor given off by the filament; or the filament acts catalytically on the gas, producing a chemical change in the the gas, but no permanent change in the filament; or the gas is chemically changed or made to react with the filament by means of electric discharges through the gas.

Arc Lamps.

In the report of the 1913 Committee, reference was made to work on the relation of pressure and temperature in arc lamps. This work has been continued, and some striking results have been obtained. The temperature of the evaporating solid crater of the positive carbon at atmospheric pressure was deduced as 4,200° C. absolute, a higher value by 200° or 300° than that generally accepted heretofore. The temperature of the negative crater was found to be lower by several hundred degrees. If the pressure is decreased below one atmosphere the temperature of the positive crater decreases. When the atmospheric pressure is increased the temperature of the positive crater increases with a corresponding increased efficiency. At a pressure of 22 atmospheres the surface brilliancy had increased to 18 times the value at one atmosphere pressure. There results were obtained with impregnated carbons, it having been found impossible to maintain a "true arc" with pure carbons at pressures greater than one atmosphere.

An arc lamp of an entirely new type is foreshadowed in a patent issued in England for an arc between tungsten or similar electrodes enclosed in a bulb, containing nitrogen or other inert gas. The electrodes are horizontal and of small diameter, and the arc is struck by a simple thermo-mechanical device.

Lamps for Projection Purposes.

Search Lights.—Recently the United States Navy has secured a search light of novel form, already used in Europe. It is 44" in diameter, and instead of the usual silver mirror, has a gold mirror, that can be controlled automatically from a distant station. It is claimed that the gold gives a beam of light more effective in showing detail, and with greater penetrating power in fog.

In the Swedish army, a search light employs a pellet of ceria on which the oxy-acetylene flame is concentrated. The consumption is stated to be about 40 liters of acetylene and 40 liters of oxygen per hour, and enough of both is carried with the instrument provide for 20 hours burning.

A portable search light has been developed in this country in which a 20" waterproof projector is used, with a 750 watt focusing type non-vacuum tungsten lamp. The projector and battery weigh 600 pounds and are mounted on a two wheeled carriage. One charge of the battery is designed to give 7 hours service.

Miner's Lamps.—As a result of the stringent rules of the British Home Office there has been a steady development in lamps for miners. Six new types have been approved.

Headlights.—A big reduction in power consumption without reduction in illuminatitg effect in street and surburban railway headlights has been made possible by the new concentrated filament tungsten lamps, which are replacing arc lamps for this work.

The importance of the problem of the glaring auto headlights, which has caused so much adverse legislation and ill-feeling has been recognized. Tests have been worked out that may be used as a standard definition of what constitutes a dangerous "glare," and the results will be submitted to manufacturers of headlights, with a view to eliminating the trouble at the source.

Signal Lights.—Fulfilling the forecast made in last year's report, semaphores are eliminated in a block signal system now being installed on one of the large railroad systems. White electric lights are arranged on a black background so that the three positions of a semaphore can be imitated. Two boards corresponding to two semaphore arms are used for each track, the upper corresponding to the stop signal, the lower to the cautionary signal. These signals are used both by day and night.

The familiar oil lantern carried by train men is being displaced by an electric lantern built along the same lines, a dry battery carried in the space formerly occupied by the oil.

Owing to reckless automobile driving, the old "Stop, look and listen" signs at grade crossings are no longer efficient in preventing accidents. One railroad uses large illuminating sign boards to educate the public in "Safety First," and warn automobilists and others to use care in crossing tracks. A new type of railroad track warning signal consists of a blackened tube containing a condensing lens behind which is a strong incandescent lamp backed up by a reflector. The tube is mounted so as to point in the direction from which the motorist will approach, and the placing of the light well back in the tube makes it almost as effective by day as by night.

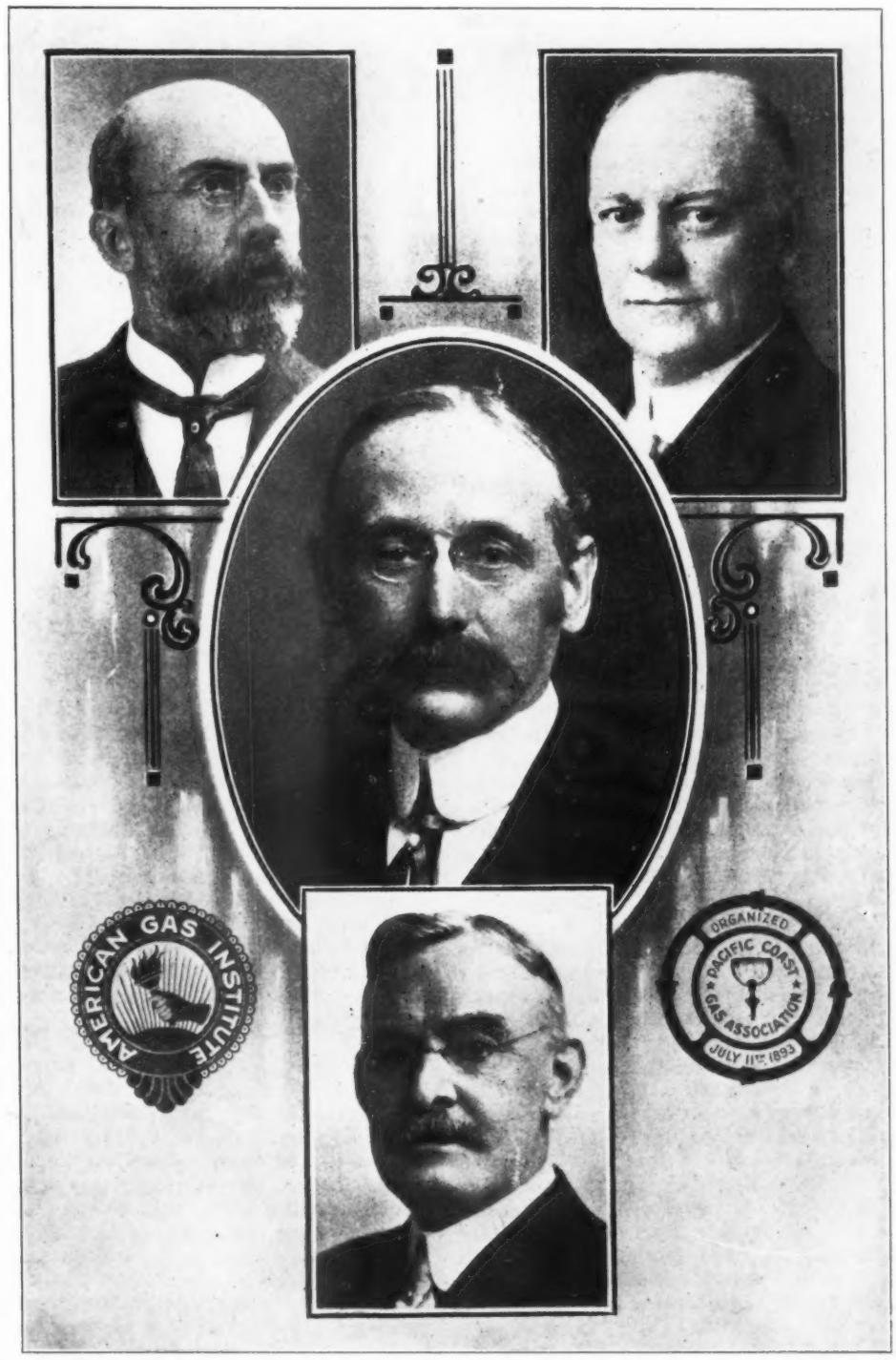
Street traffic controlled by means of signal lights, described in last year's report, is being tried out in Pittsburgh.

There is evidence of the increased use of light as a danger signal.

A novelty is a small lamp with a reflector, to be attached to an electric iron, which not only illuminates the cloth in front of the iron, but acts as a tell-tale in case the current is left on when the iron is not being used. Work is also being done on the development of small lamps for use at the needles of sewing machines.

War.—The great war furnishes an opportunity for the study and an incentive for the development of certain classes of illuminants. In its activity may be seen the application of the latest ideas regarding such factors as glare and the power of light of certain colors to penetrate fog. Active fighting is no more confined to daylight than business, and the old type of romantic sorties under cover of darkness are made almost impossible owing to the frequent and brilliant flashes of illumination.

mobile trucks forming the carriers and supplying the power. The lights may be operated either on the truck or at a distance from it. The French have a device control employing the response of a tuning fork at the searchlight to a vibrating current sent from a contact breaker tuned in unison with the fork. Gilded mirrors are being used instead of glass. Searchlights are used not only to detect the movements of the enemy, but to blind troops when they are charging across the zone of fire, and to discomfort the pilots



Officers of the recent International Gas Congress. The central portrait is of Dr. A. C. Humphreys, L.L.D., S.C.D., president of the Congress; above are seen (left) Mr. George G. Ramsdell, secretary of the Congress and seoretary of the American Gas Institute; and (right) Mr. E. C. Jones, vice-president of the Congress, president of the American Gas Institute and president of the Pacific Coast Gas Association. The lower portrait is of Mr. John A. Britton, chairman of the Pacific Coast Gas Congress Committee.

A recently designed signal device consists of a pair of binoculars over which is mounted a small parallel beam flashlight, the battery carried in the belt of the user. The average range of the instrument is about 3 miles. An electric flashlight apparatus used by the British is similar in size and appearance to an ordinary camera. A large lens is provided at the front of the box and flashes are made by means of a telegraph key that closes the lamp circuit.

Searchlights.—Traveling searchlights have been developed, auto-

of aeroplanes. Some of them will throw an intense light for miles. The blinding and confusing effect makes it impossible to advance a body of troops in the face of strong searchlights, a practical illustration of the effect of glare.

Illuminants.—Another type of illuminant used is the luminous cartridge, which serves for the illumination of nearby fields and especially for investigating and exploring purposes. It is fired from its own pistol and has a range of action of about 200 meters

and a luminous area of about 100 meters. It burns from 8 to 10 seconds. Similar to it is the light-rocket discharged from a musket. It is fired from 45 to 900 meters, and lights up an area from 500 to 600 meters in diameter with an illumination almost as great as daylight and lasting from 30 to 40 seconds. Flares have been developed similar to what are known as red, white and blue fires used in Fourth of July celebrations. These are set out by sappers in front of the battle line and are controlled from the headquarters of the officers. Ignited at intervals they keep the battle front illuminated throughout the night. Star bombs shot from mortars maintain an intense illumination for as long as 20 minutes. For distance lighting a projective similar to shrapnel is used, so constructed that it furnishes light after a definite time and at a predetermined height. Torches have been developed that burn from 2 to 3 hours.

Safety Lighting.—The danger from night raids by Zeppelins or other air crafts has made it advisable to reduce the lighting in cities and towns in England and France. In Paris, in the neighborhood of the Eifel tower, lighting has been cut out almost entirely. As a sample of the order for reducing lighting used in London is the following: In all brightly lighted streets, squares, and bridges, a portion of the lights must be extinguished, so as to break up all conspicuous groups or rows of lights, and the lights not extinguished must be lower in intensity, or made invisable from above by shading them or painting over the tops of the globes, providing that while thick fog prevails normal lighting may be resumed. Sky signs, illuminated facias, illuminated lettering, and powerful lights of all description used for outside advertising or for the illumination of shop fronts must be extinguished. Subsequently the above orders were made more inclusive by prohibiting all lights outside of shops. This same order called for rear lights on vehicles. It is interesting to note that while we have had rear light ordinance for years, it has taken war conditions to make the desirability of such lights apparent in London. In consequence of the lighting conditions, it is claimed that there has been a large increase in fatalities caused by accidents. Curious complications have arisen over the question of payment by shopkeepers for exterior illumination that they are not receiving.

Experiments have been made by one of the street car companies of London to meet the requirements of reduced lighting and still furnish light enough to allow the passengers to read. The lamp shades used in the lower part of the car are dipped in a violet lacquer, thereby reducing the illumination by 50%. In the upper part of the car a similar treatment is given, and the shades arranged so as to throw the lights across the car. The dash lights are covered with yellow paper. Dipping the lamps themselves were found to give unsatisfactory results.

The Panama-Pacific Exposition.

In its use of light, the Panama-Pacific Exposition furnishes the most striking example of the progress of illuminating engineering ever presented. For the first time in the history of such institutions, a recognized illuminating engineer was called in to take care of that branch of the work. For the first time in history the lighting of an International Exposition was completely designed and charted before the buildings were erected, and the results bear eloquent testimony to the wisdom of that action. The latest types of street lighting, both gas and electric, are represented; the exteriors of the buildings are brilliant with "flood lighting"; the lighting of Festival Hall is a unique example of totally indirect lighting; display lighting is exemplified in the wonderful scintillator system and in the Tower of Jewels; efforts to avoid glare are manifest on all sides; never has there been a more lavish use of colored light. And so this exposition stands as a living witness to the fact that illuminating engineering has "come into its own."

The basic idea of the general illumination was to present the exposition at night in the same relative values of color and perspective in which it is observed by day. On this account the old outline system of illumination was abandoned in favor of the flood-lighting idea and particular attention was paid to the ocular comfort of the sightseer.

Four principal methods of illumination are employed. Opposite the walls of the exhibit palaces are luminous art standards bearing transparent shields, through which light is thrown upon the fascades. Concealed batteries of searchlight projectors flood the monumental sculptures, towers and minarets, so that the minutest architectural details are visable. A third source is the light that proceeds from the inner recesses of the columns that encircle the courts, or are placed on the lofty Tower of Jewels and the Italian Towers commanding the entrance to the Court of Palms and the Court of Flowers. This method of lighting is also used in the vaults of archways, and in other places, to cast light upon the mural paintings. The great battery of 48 searchlight projectors, each with a 36″ lens forming the "scintillator," makes a fourth source of illumination.

In addition to these four principal sources there are several minor ones. In various parts of the grounds are globes of white glass, the light from which dissipates the shadows under the foliage. In the great central Court of the Universe two lofty columns of dense white glass are parts of the two fountains, and are the principal source of the night illumination of the Court.

The striking effect of the Tower of Jewels was obtained through the use of specially designed jewels of Bohemian glass, having an index of refraction of from 1.68 to 1.71. Each gem is suspended so as to be free to swing with air currents, and has a little mirror placed within one-sixteenth of an inch of the apex, thereby increasing the number of spectra obtainable.

A noteworthy feature of the highway lighting is the use of 18″ to 24″ globes, with an absorption of approximately 50% and of a warm opal tint approaching amber. The illumination of the interiors of the buildings is by 250 to 500-watt tungsten lamps in mirror reflectors. The lamps are from 40 to 100 feet above the floor; the energy is less than 2 watts per square foot, and the foot candles range from ½ to ¾ on the floor.

The first commercial installation of high pressure gas lighting in this country, and one which is said to show many improvements over foreign practise, is in the State and Foreign Building Section. The main artery for traffic is the Avenue of Nations, and this and other streets and avenues in this section are lighted by high pressure two-mantle lamps enclosed in opal globes mounted single on the top of ornamental staff work columns. The lamps consume 21 cubic feet of gas per hour, operate at 3 pounds pressure, reduced at the standard from 30 pounds, and have a mean sperical candle power of 408. Installations of these lamps have been made at all the entrances and exits of the grounds. At the entrances and exits of the main group of exhibition palaces, and at the entrances of the courts, gas lamps of the low pressure type are used, mounted on brackets. In the "Zone," gas standards 35 feet high are placed at intervals of 100 feet on both sides. There are 72 of these standards, each carrying 5-mantle lamps with mercury valve distance control. Large decorative lanterns are hung about these lamps. Decorative effects are obtained by the use of gas to produce tongues of flame from serpent-headed urns.

Some very spectacular effects are obtained in the lighting of the glass dome of the Palace of Horticulture. These effects are made possible by the use of sets of specially designed lens plates, color screens and high-powered searchlights. The system used in lighting the interior of Festival Hall is unique. In a pit beneath the floor are a number of searchlights set to throw their beams upward into a diffusing disk of thick glass sand-blasted on the under side, which distributes the light over the dome covering the auditorium, the dome in turn acting as a diffusing reflector.

Street Lighting.

Display Lighting.—A general survey of the progress in the lighting of streets show that there has been a decided increase in ornamental lighting for advertising purposes, so-called "White Way" lighting.

There is a tendency away from the use of 5-lamp standards inasmuch as they are too prominent in the daytime, preference inclining toward a single or at most a double-light unit with a comparatively high candle power lamp. The introduction of the gas-filled tungsten street series unit has, in general, resulted in increasing the candle power used and not decreasing the wattage. The feasibility of replacing arc lamps with incandescents for street lighting has been agitated ever since the introduction of incandescent units of sufficient intensity to produce comparable results. The question has been re-opened since the introduction of the high candle power tungsten lamps.

Great Britain.—The report issued by the British Government on the use of gas during the year closing June 1, 1914, shows an increase in the number of gas consumers in Great Britain of 357,411. The report also states that while the use of electricity for street lighting is increasing, there are still 779,442 incandescent gas units in use.

Berlin.—The number of gas lamps in use for pubiic lighting in Berlin, March 31, 1914, was 43,780, an increase of 2,324. As in previous years, there has been an increase in high pressure lighting in the principal streets. In the upper parts of the city illumination has been strengthened by increasing the number of burners in a lantern, by increasing the number of many-flame low

pressure inverted lamps, as well as by increasing the number of lamp standards.

Other Exterior Illumination.

The continued improvement in illuminants is reflected in the spread of out-door-lighting of all kinds and the use of light for a variety of purposes. Thus a real estate dealer arranges to have a new sub-division highly illuminated, and rapidly sells his lots to customers who come out to view them at night. Improvements in distance lighting and control have made feasible the employment of gas in places where its use had previously been considered impossible. A big extension is to be noted in the use of light for exterior advertising purposes.

Flood-lighting.—One of the most striking illustrations of modern "flood-lighting" is the lighting of the Woolworth building in New York city. It is said that more light is provided for the illumination of this tower than is usually employed in lighting a city of 30,000 inhabitants. Six hundred automobile projector units fitted with 250-watt, gas-filled tungsten lamps are used to throw light on the structure from the thirtieth to the fifty-eighth story. These projectors are arranged so that some throw their light upward and others downward. Thus there is diffusion of light over the whole surface. The lamps throwing light downward are screened so as not to be directly visible from the street. The most novel point of the installation is at the sixtieth story called the "crow's-nest" or "lantern." It has been enclosed with diffusing glass and within are placed twenty-four 1,000-watt lamps. An automobile dimmer connected with these lamps continuously alters their intensity in an irregular cycle. Thus at one instant the glass surface of the lantern shows a deep red glow no brighter than the adjacent gilded structure, and again it flares up to a bright white light visible for miles.

The flood-lighting idea has been much extended in the illumination of advertising signs on billboards, water tanks, roofs of buildings, side walls and elsewhere. In such cases the effect is accomplished by directing a beam of light against the sign from some nearby convenient location, and a new lighting unit of high intensity utilizing a parabolic reflector has been recently developed for this purpose.

Lighting of Sports.—The lighting of courts for tennis and other sports has proved so satisfactory that the idea is being tried out in a number of different ways. A playground in a city park has been illuminated so that its various amusements are available at night as well as by day. Five 750-watt, gas-filled tungsten lamps are used to light the football field while 1,000-watt units illuminate the swings and gymnasium apparatus. These units are placed 20 feet above the ground on goose-neck boulevard posts. A test was made at the Indiana State Fair grounds recently to try out the practicability of automobile racing at night. The result was a complete success. Lights of the type used in contracting and railroad work for emergency operations at night, were placed at intervals about the track, each light supplied from its own cylinder of dissolved acetylene. In another case an outdoor skating rink used for curling was lighted by tungsten lamps installed on two lines of wire, extending the length of the rink. Tennis courts and golf putting-greens have been successfully lighted with high power gas lights.

Interior Illumination.

The trend in interior lighting continues to be in the direction of protecting the eyes from excessive brightness.

Hotel Lighting.—A recently finished, and what is claimed to be the largest hotel in Europe, has been fitted throughout with the semi-indirect system of illumination. In the dome of the rotunda court, are opal bulls-eyes, with a lamp behind each, in the risers that support the glazing of the dome. Around the dome cornice is a ring of lamps, concealed from view at the floor level, that throw a considerable volume of lights upward into the dome. In England the use of high pressure gas is being extended to factory lighting.

Office Buildings.—Heavy glass partitions, translucent, substantial, sun-proof and fire-proof, are being introduced, as a means of distributing sunlight through large office buildings, without lessening the privacy of the various offices. These partitions are of clear glass units, 2″ thick, 6 or 8″ square, reduced to translucency by impressed designs.

Hospitals.—That the educational work of the Society on the subject of color and glare is bearing fruit, is seen in the use of green and buff for the color of the walls in a large Western hospital. White had always been used, but it was found that the discomfort from the necessity of eye-adaptation on the part of surgeons looking up from their work, and seeing only white clothed assistants and white walls, was largely eliminated by the use of other colors. The effect on patients has also been beneficial.

Street Railway Cars.—A growing recognition of the importance of proper lighting in every sphere of activity is illustrated in the recent extensive tests conducted by a large municipal railway. A full sized template car was built and tested with direct, semi-indirect and totally indirect systems of lighting. The general effect and appearance of each system under test were judged by comparison with present methods of car lighting for similar service. The effect of the light on eye was particularly noted. The system finally adopted consists of a single row of 56-watt, bowl-frosted tungsten lamps, placed symmetrically down the center line and equipped with opal glass reflectors; supplemented by six 10-watt, all frosted round bulb tungsten emergency lamps. One big unit was placed on each end-bulkhead of the car to bring up the illumination at these points. As finally equipped, the illumination averaged 5.94-foot candles, at normal, and 3.85 at 85% voltage, the energy consumption was 1.44 watts per square foot, effective lumens per watt 4.14, and the utilized efficiency 50.6%.

Another street railway company is emphasizing the "Safety First" principle by providing a light to directly illuminate the step of the car. A practical application of signal lights has been adopted by some of the theatres of Vienna. On the back of each seat is a small electric lamp which illuminates the seat number. As long as the seat is turned up, as when not occupied, the light burns, but is shut off when the seat is turned down. By this the use of ushers has been materially decreased.

Clock Tower.—A novel use of indirect lighting is the illumination of clock dials in the new Boston Custom House. Behind each dial is a chamber with white walls, illuminated by a number of lamps. Numerals of the dial are in the form of slots, set in concrete, and the lights in each chamber are so arranged that no unreflected light passes through the slot. The effect is to make each numeral appear as if cut out from a piece of uniformly lighted paper.

A clock tower in Philadelphia is lighted with gas arcs, automatically lighted and extinguished by a part of the clock movement.

The art-glass dome is ordinarilly associated only with the lighting of dining-rooms, but it has been added to the long list of fixtures used to produce attractive show window illumination.

Reflection.—Now that semi-indirect and totally indirect lighting systems are coming more and more into use, the effect of the walls and ceilings in reflecting light is of great importance. The results of considerable work on tests of the reflecting power of paints, have been presented. The colors examined ranged from white to dark buffs and greens. The highest coefficient obtained was 0.657, for a white oil paint of medium gloss. Less than one-half of the samples tested showed coefficients above 50%, and all of those that did so were of very light creamy or yellowish tones. A rather light olive green gave only 0.328.

Code.—Reference should be made to the very important work of the Committee on Lighting Legislation and the Factory Lighting Committee of this Society, as a result of which a code on the lighting of factories, mills and work-places has been prepared.

Globes, Reflectors and Fixtures.

Having plenty of light available from gas or electricity, manufacturers have increased the variety of materials used in making globes, reflectors and shades. At one extreme might be put the wicker basket, which, with or without a lining, is suspended from the ceiling as a semi-indirect fixture; or inverted and covered with suitable material makes a shade for a table lamp. At the other extreme is the hammered brass bowl, with or without glass inserts, used either for totally indirect or semi-indirect lighting. There is a growing use of floor lamps having very large shades and mounted on standards 5 or 6 feet high. It is replacing the old center table lamp for family reading, and inasmuch as those using it can all have the light properly directed for reading, it forms a step toward eye protection. There is also a growing trend on the part of architects to call for lighting fixtures that conform to the period of their surroundings.

In school rooms an increasing tendency toward the use of denser glassware and semi-indirect lighting is noticeable; and in general, for both direct and semi-indirect systems denser glassware is used. Furthermore the tendency toward increased candle power in small units has led to a greater use of diffusing media such as marble and alabaster, and to fixtures carrying several lights burning upright with small semi-indirect shades. The use of cloth for shades is growing, and an umbrella manufacturer has developed a collapsible shade of cretonne, which can be folded up when not in use.

For the large modern office building an equipment of specially designed fixtures is not uncommon. In one case a fixture was de-

veloped that can be utilized either for direct, semi-indirect or totally indirect lighting. There is evidence of a considerable increase in the employment of the semi-indirect type of fixtures for gas.

Great advance has been made in gas fittings. The old "goose neck," braced with wires, is being replaced by straight pipe with gas-tight adjustable couplings, which makes a variety of brackets available.

Reflectors have been developed for converting the ordinary gas arc into a semi-indirect unit, thus meeting the demand for this type of lighting without the necessity of scrapping former fixtures. The advent of the 100-watt, gas-filled tungsten unit has caused the development of prismatic and mirrored reflectors for use in show-window lighting.

In lighting fixtures of ornate design and equipped with electric candle or candelabra lamps, the use of ordinary key or pull sockets for individual lamp control is often undesirable and esthetically objectionable. A rotating switch has been devised to meet this condition, operated by turning an outer sleeve forming part of the candle. The replacing of arc lamps by the new high efficiency tungsten lamps has resulted in an adaptation of the fixtures of the former to act as housings for the latter. The principal change is the introduction of baffle plates to prevent the entrance of rain without hindering the ventilation.

A reinforced concrete lighting standard of attractive design and appearance is being installed in a number of California cities, including beach resorts, where metal standards have suffered severely owing to the action of salt air.

Photometry.

The measurement of light sources differing in color value continues to interest the photometrist. Developments have followed two general lines, one the elimination of the color difference, thereby reducing conditions to those of ordinary photometry; the other the use of the flicker photometer, which has not yet been generally accepted as a solution of the problem.

Secondary Standards.—At the National Physical Laboratory in England there has been completed an exhaustive research, having for its object the establishment of a set of standards matching in color lamps operating at the various efficiencies in ordinary use. In this research the color problem was met by using the so-called "Cascade" method, in which a lamp at a given watts per candle is measured against one whose watts per candle differs by an amount which will make the color difference small enough not to be objectionable. The experience was that whereas an observer may be relied upon for constancy in judgment in measuring with an ordinary contrast photometer sources differing by a small amount in color value, the same constancy was not obtainable where the color differences were large. Efforts were made to use the flicker photometer, but the results were not satisfactory.

Color Difference.—It is interesting to note that elsewhere in observations on color differences made with a flicker photometer and extending over a year, individual observers reproduced their results with very few exceptions.

The color screen method of eliminating the color difference in heterchromatic photometry has been extended by the development of a blue solution, which in varying degrees of saturation will provide a color match between a standard carbon lamp and another lamp operating at any watts per candle from 3.1 to 0.5. An alternative for the color absorbing solution is suggested in a new photometer using polarized light. It is based on the rotation of the plane of polarization by a quartz plate and the fact that this rotation is different for light of different wave-lengths.

Flicker.—By applying to a modified form of the Conroy photometer, an oscillating platinized mirror and adding an optical wedge having its density gradient vertical and different by 2% from top to bottom, a new flicker-photometer has been developed. Another arrangement for a flicker-photometer consists in a modification applicable to the ordinary Lummer-Brodhun photometer head.

Integrating Sphere.—At the last convention there was discussion on the best paint for the inner surface of an integrating sphere. An elaborate research was undertaken in Germany to decide this point and the best matierial of which to make the sphere itself. The results indicated that iron plate is to be preferred to zinc for material, and that zinc white paint as the diffusing surface gives the best results.

New Instruments.—A new portable illumination photometer has been brought out, a modification of the Weber type and much more compact. Another illuminometer has been described for use where rapid and rough measurements of light intensity are desired. In this instrument a screen of black silk illuminated from the rear is viewed in comparison with tinted sectors, on which falls the illumination to be measured. The intensity of the light from the comparison lamp is controlled by an iris diaphragm. As a quick means of determining the various energy relations in tungsten lamps, a direct reading instrument has been devised using data presented at the last convention. It is made up of volts, watts per candle and per cent. candle power scales. The volt scale has a range from 94 to 166 volts, while the watts-per-candle scale limits are 0.70 and 2.05. Knowing any two relations, the other may be calculated within the range of the instrument.

Photo-electric Cell.—In astronomical photometry work is being done with some success, looking toward increasing the sensibility of the photo-electric cell. A null method of using photo-electric cells has been devised, which, it is claimed, does away with the so-called "dark current" without reducing the sensitivity.

Pentane Standard.—A redetermination at the National Physical Laboratory of the constants of the Pentane lamp gave the following as the equation of the candle power:

C. P. $= ((1 + 0.0063\ (8 - e) - 0.0008_5\ (760 - b))$; e being the humidity in liters of water vapor per cubic meter of moist air, and b the barometric pressure in millimeters. Evidence was obtained that there exists a temperature coefficient in the case of the pentane lamp, a point which had been raised previously at the Bureau of Standards. Apparently the temperature and humidity effects act against one another, and in practice it is the difference between the two which is operative. It is suggested that if work of the very highest accuracy is to be carried out with standards under abnormal humidity conditions, the combined humidity temperature coefficient should be determined for the locality in which the work is to be conducted.

Calculation.—Methods of calculating the illumination produced by a direct-lighting source are numerous and well known. But in the case of a totally indirect or semi-indirect unit the calculation is decidedly modified. A method has been proposed in which it is necessary to know only the photometric curve, the coefficient of reflection for the secondary source (usually the ceiling), the distance of the unit below the ceiling and the height of the ceiling above the plane of illumination. Roughly the method involves the consideration of the ceiling as a secondary light source considered as made up of a series of circular annuli or rings of uniform intensity of illumination. The effect of each ring is calculated independently.

Nomenclature.—Considerable attention has been given to the subject of nomenclature. It has been proposed that the word "lambert" be used in referring to brightness in lumens per unit projected area. The "lambert" is interpreted as the equivalent in appearance to the eye of a surface source emitting one lumen per unit area in accordance with Lambert's cosine law. The following resolution which was submitted by the Committee of Nomenclature and Standards has been approved by the Council of the Society:

Resolved, That it is the opinion of the Committee

(*a*) That the output of all illuminants should be expressed in lumens.

(*b*) That illuminants should be rated upon a lumen basis instead of a candle power basis.

(*c*) That the specific output of electric lamps should be stated in lumens per watt, and the specific output of illuminants dependent upon combustion should be stated in lumens per B. T. U. per hour.

Photography.

Sources.—The use of gas light for taking pictures is increasing, and special mantles have been designed for the purpose. In order to facilitate the use of the high intensity gas-filled tungsten lamp in photographic portrait studios, a colored glass screen has been developed which reduces the luminous intensity of the light to one-third its ordinary value without appreciably reducing the actinic value for ordinary plates. For convenience this glass is incorporated in the lamp bulb. Thus high candle power lamps may be used without producing an uncomfortable glare. It has been found possible to use such lamps, screened as described, in moving picture production studios. In a big western moving picture plant there is used a combination of mercury vapor lamps and 2,000-candle power tungsten gas-filled units of the type just mentioned. In Germany tests have been made on the use of the gas-filled tungsten lamp for photographic work at voltages higher than normal, thus giving greater actinic value. This same idea has been proposed and experimented on in this country.

Tests have been made on the density of the photographic image produced under fixed conditions of distance and time by the light

from the different types of arc lamps under various conditions. The lamps tested were of the alternating current or direct current enclosed carbon and flaming arc types operated at various currents. The results showed that the highest actinic efficiency was obtained by the 220-volt, enclosed carbon arc; next in value were respectively, the alternating current and direct current 110-volt, flaming arcs, with electrodes designed particularly for photographic work.

A photographic paper has been developed on which portraits may be reproduced directly, without the preparation of the usual negative. For operation with artificial illuminants the paper is treated with a dye, which makes it more sensitive to yellow light. The pictures are mirror images of the original.

Legislation.

Calorific Standard.—The Illinois Commission has ruled that in all parts of the State, excepting Chicago, a calorific standard of 565 B. T. U. for gas shall be used. Chicago is to remain under the candle power standed. The calorific standard has been adopted by the Maryland Public Service Commission. A heating value of 600 B. T. U. is specified. It was estimated by the Commission that in the State generally only 6 to 10% of the gas used is burned in flat flame burners. The use of the calorific standard in gas undertakings does not seem to be growing rapidly in England. Only eight companies have applied for Parliamentary authority during the session of 1915. Four of these companies applied for a 500 B. T. U. standard.

Glare.—Extremely bright lamps are no longer allowed on residential streets, especially in front of isolated stores in Washington, D. C. Regulations adopted prohibit the use of lamps exceeding 100 candle power on streets other than business streets. They also require a minimum height of 15 feet for all private lamps supported from sidewalks, and that such lamps are to be enclosed in opalescent globes in order that the eyes of passers-by shall be protected from glare.

A bill has been introduced in the Utah Legislature providing for the creation of special lighting improvement districts, under which the property owners on any street or sub-division may petition the city commission to create such districts and to install lighting systems.

Safety.—The Ottawa (Canada) City Council have recently passed a by-law providing that the stairs, halls and corridors of all apartment houses, hotel and lodging houses must be lighted from sunset to sunrise.

In places where public safety demands it, there is a growing tendency on the part of municipal authorities to require two independent systems of illumination, so that in case of failure on the part of either, the other will be available.

Illuminating Engineering in General.

Daylight Saving.—By adopting eastern standard time, Cleveland, O., has added one hour to the period of daylight. The result has caused a renewed interest in the so-called "daylight saving movement" in the middle west. In Holland also this movement is being agitated.

The use of light sources imitating daylight is growing, and has been found advantageous not only in clothing, painting and wall paper stores and factories, but also in printing and lithographing establishments, paper mills, oil refining plants, cigar factories, etc.

Luminous Efficiency.—Values of the radiant luminous efficiencies (ratio of the energy radiated evaluated according to its effectiveness in producing the sensation of light, to the total energy radiated) of various light sources have been determined using the method that employs an absorbing solution whose transmission curve is the same as the luminosity curve of the eye. Among the results obtained were:

4 w.p.c. carbon lamp	0.43
0.8-ampere Nernst filament	1.08
6.6-ampere gas-filled tungsten at 0.65 w.p.c	2.93
Ordinary vacuum tungsten at 1 w.p.c	1.99
Open burner, gas	0.9
Incandescent mantle, gas	0.5 to 1.2
1.7 ampere mercury arc, Pfund type	30.0

A new experimental determination by two different methods gives for the mechanical equivalent of light a mean value of 0.00162 watt per lumen.

Physiology.—Further work has been done on the effect on the eye of ultra-violet light. It has been shown that where the protein in the lens of the eye has been modified by the action of excess sugar in the body fluids, or by the action of salts of calcium, magnesium, silica and the like, ultra-violet radiation may cause cataract, but that unless this abnormal condition exists cataract is not caused by this form of radiation.

International Commission.—At the meeting of the National Illumination Committee of Great Britain held early in the year, there was considered the question of "Rating of Light Sources in Candle Power or Consumption," and the following resolution was passed and transmitted to the Secretary of the International Commission on Illumination.

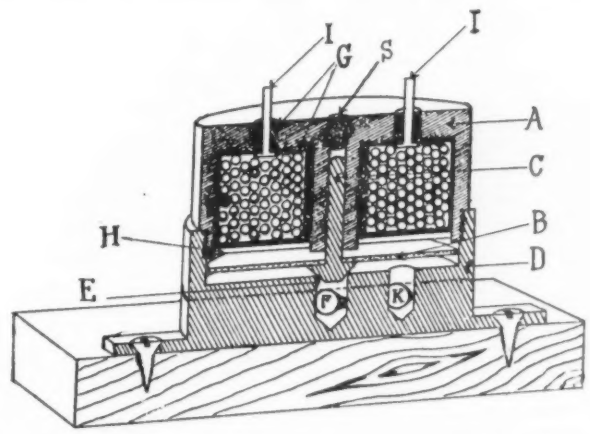
"It is desirable that a uniform international method be adopted for rating and marking all sources of light. It is recommended by the National Illuminating Committee of Great Britain that the matter be considered at the next session of the International Commission on Illumination; and the administration of that Commission is asked to take the necessary steps to bring this resolution to the knowledge of the different national committees, with the view to their co-operation."

A Simple Electrically Operated Gas-Valve.

[Zeno Ostenberg in Journal of Ind. and Eng. Chemistry.]

The valve herewith illustrated was built to regulate the flame of a double-burner gas-stove, that heated a water bath 24" in diameter. Since two of them have been in operation for over a year and a half, with entire success, it was thought that a description and illustration of the mechanism would be useful.

The mechanism consists essentially of the "iron-clad" electromagnet, *A*, which lifts the iron disc, *B*, to which is attached the brass valve and stem, *C*. The valve, *C*, makes a gas-tight fit with the main brass body, *D*, at the inlet, *E*, when no current is passing through the magnet winding; but when current is sent through the winding, the disc, *B*, and valve, *C*, are raised, and gas is allowed to pass from, *E*, to *K*, which leads to the burner. *F* is the outlet to a pilot light. The disc, *B*, is prevented from sticking to the magnet, *A*, by the plug, *S*, which may be screwed down to limit the travel of the valve stem, *C*. *G* is insulation which must be able to withstand a rise of temperature to about 100°, as the magnet sometimes becomes quite hot. The brass disc, *H*, is soldered gas-tight to the magnet, *A*, to prevent moisture and gas from attacking the wiring, and to keep the wiring in place. The gas inlet tube (not shown) enters opposite to the pilot opening, *F*. When operated from a 110 volt line, the winding consists of No. 26 d. c. c. copper wire with a 16-candle power carbon lamp in series. This allows slightly less than 0.5 ampere to pass through the winding of electromagnet. For use with a storage battery No. 30 wire is used.



The electrical circuit is opened and closed by a 75 ohm standard Pony relay, operated by a dry battery and thermo-regulator. The dry batteries put into the thermo-regulator circuits over a year and a half ago are still able to operate the relays as only about 0.02 ampere is used, and this amount of current is so small that no trouble has been experienced from oxidation of the mercury at the contacts in the thermo-regulators.

Obviously the valve may be used on any size burner, from the smallest micro-bunsen to one with a gas inlet equal in size to the outlet of the valve. In the valves in use the hole is 0.25" in diameter.

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NEW YORK, MONDAY, NOVEMBER 1, 1915.

Picture of Delegates and Ladies—International Gas Congress.

With this issue we present to our readers a supplement showing a group of delegates to the recent International Gas Congress, held in San Francisco. All branches of the industry are well represented in the picture.

Window Display Service.

The National Commercial Gas Association has been considering for some time the employment of a Window Display Expert as a permanent member of the headquarters staff. He will have at his command facilities for preparing model show windows, and the Association will thus be able to give member companies a high class window display service.

Companies subscribing for this service will be given at least one or two seasonable and attractive window display layouts each month, and the Window Display Bureau will also plan special displays upon request.

Show window space has a real money value not always fully taken advantage of, and if the service the Association contemplates is supported by subscriptions from enough companies, and they use their show window space to the best advantage, the small expense of the service should be gotten back many times over by the subscribers.

The cost of this service will be

$25.00 per year to companies serving a population of 75,000 or over.

$20.00 per year to companies serving a population of 25,000 to 75,000.

$15.00 per year to companies serving a population of less than 25,000.

A monthly prize will also be given for the best window display submitted by companies subscribing to the Association service, which will give the prize winner practically the entire annual cost of the subscription.

The Association offered $100 in prizes for the best window displays planned by gas company employees and used by their companies during National Gas Lighting Week, comprising: Four first prizes of $15.00 each, four second prizes of $7.50 each, four third prizes of $2.50 each, to be awarded in State groups. The large number and the quality of the displays submitted in the contest was surprising and encouraging to the Window Display Committee who awarded the prizes as follows:

First Group.

1st Prize—$15,00, to H. J. Gerlich, Flatbush Gas Company, Brooklyn, N. Y.

2nd Prize—$7.50, to J. Frantz-E. Wilkens. the U. G. I. Company, Philadelphia, Pa.

3rd Prize—$2.50, to J. Shelley, Public Service Company, Jersey City, N. J.

4th Prize—$2.50, to E. C. Weston, the Middleton Gas Company, Middletown, Conn.

Second Group.

1st Prize—$15.00, to J. T. Stallings, Southern Gas Improvement Company, Elizabeth City, N. C.

2nd Prize—$7.50, to W. A. Conway, Wilmington Gas Company, Wilmington, Del.

3rd Prize—$2.50, to S. B. E. Thompson, Martinsburg Gas Company, Martinsburg, W. Va.

Third Group.

1st Prize—$15,00, to Frank Jones, Logan County Gas Company, Lincoln, Ills.

2nd Prize—$7.50, to M. M. Moore, Indiana Lighting Company, Wabash, Ind.

3rd Prize—$2.50, to W. C. Farmer, Des Moines Gas Company, Des Moines, Ia.

Fourth Group.

1st Prize—$15.00, to Leonard Holder, Utah Valley Gas and Coke Company, Provo, Utah.

2nd Prize—$7.50, O. A. Goff-C. Wilhelmi, Grays Harber Gas Company, Hoquiam, Wash.

It is expected that many gas companies will subscribe to the Window Display Service offered by the Association, and the work will be started as soon as the cost for the first year has been pledged.

Influence of Temperature on Strength of Concrete.

Bulletin No. 81 of Engineering Experiment Station of the University of Illinois, presents a study of the data obtained from three series of tests on concrete tubes and cylinders that are stored under temperature conditions varying from 25° to 90° F. and tested at various ages up to 28 days. Curves are presented to show the relation between strength and age for different conditions and the relation between strength and temperature. The result of the tests made at freezing temperature are of especial interest; showing the gradual and slow gain in strength under storage temperature, still below freezing, and the disintergrating effect of alternate thawing and freezing. The Bulletin would be of value to contractors, engineers and others interested in construction work.

Copies of the Bulletin may be obtained gratis from W. F. M. Goss, director of the Engineering Experiment Station, University of Illinois, Urbana, Ills.

Philadelphia Gas Meeters—Hallowe'en Party.

The Roof Garden of the Hotel Adelphia, Philadelphia, on Thursday evening, October 28th, was the scene of a happy meeting of the Philadelphia Gas Meeters. The program called for a Beef Steak Dinner, which every one knows is sufficient without speeches or other attractions, but, nevertheless, in true Philadelphia style, there were others.

Chairman Rolston called upon Mr. Michael Dorizas, formerly of Greece, but now of America, who outlined the political upheavals of Southeastern Europe for the past century, and explained many of the complicated treaties among the Balkan States. Among those present were Messrs. G. Edwin Bartlett, Sir John Franklin, Stanley Grady, Jacob B. Jones, F. N. Hamerstrom and Hugh T. Aiken.

Directors' Meeting, New Jersey State Gas Association.

The officers and directors of the New Jersey State Gas Association met at the office of the Public Service Gas Company, at Trenton, on Thursday afternoon, October 28, to formulate plans for their next meeting. New Brunswick, N. J., was selected, the date being Nov. 17. Further details will be given in the official announcement, which will appear in the Association's page in the Journal of next week.

SPECIAL ENGLISH CORRESPONDENCE.

Monthly Letter From Norton H. Humphrys, Salisbury, England.

A GAS ENGINEER ADVERTISES ELECTRICITY.—METER INDICES.—REDUCED LIGHTING IN LONDON.—A PROPOSED NEW UNIT FOR GAS MEASUREMENT.

While we are not surprised by extravagant claims on behalf of electricity, with incidental disparagement of gas, put forward by electrical engineers and other interested parties, with whom the wish is father to the thought, we certainly sit up and rub our eyes when we find an eminent gas engineer chanting to the same tune. Mr. Newbigging, Engineer of the Manchester Corporation Gas Committee, in the course of a paper descriptive of the large municipal interests which he so ably controls, recently read by him before the British Association for the advancement of science, quoted some figures bearing on the progress made by both commodities, in the course of the five years ended Dec. 31st, 1913, throughout the city and district. The advance in the use of electricity for power was 155%, and for lighting 7½. Gas lighting was practically at a standstill, but 30% more gas was used for cooking. In respect to these figures one would remark that percentages are apt to be misleading. A large percentage on a small starting basis may after all be insignificent, and actual quantities are more important, from a business point of view. Whatever the figures for electricity may be, the Gas Committee have a powerful showing. They sell some 6,000,000,000 cubic feet of gas per annum, of which 26% passes through cookers and engines. Like most other municipal bodies, the Manchester Gas Committee move slowly, as compared with directors of private companies, who have profits to earn and to maintain. They did not commence the supply of gas stoves until 1911, but up to December, 1913, they had put out over 17,000, representing a gas consumption of nearly 200,000,000 per annum. They have now 134,382 gas appliances on hire.

Yet, in face of these figures, we find Mr. Newbigging, while admitting that good progress has been made in the use of gas for cooking, heating and industrial purposes, going on to urge the necessity for a lower priced gas "in order to consolidate the position, remove it (the consumption of gas) from intermittent to constant use, and encourage still more general adoption. * * * * In the case of a municipality owning both gas and electric supplies, there is no reason why the former should not eventually become the gaseous fuel suppliers, and the latter the light suppliers," He goes on to recommend a 250 to 300 B. T. U. gas, which could be cheaply produced.

Naturally the electricians don't hesitate to accept these remarks as a confession of failure, on behalf of 500 to 600 B. T. U. gas as usually supplied, in competition with electricity, entirely as regards lighting and partially in regard to other purposes, and as an attempt at compromise with a view of saving the situation. Some of them say that there is no reason why gas should receive any consideration, and they mean to facilitate the progress, not only of gas burners but also of gas cookers, fires and engines, toward the scrap heap, and eventually gas engineers as well. That they do not correctly represent Mr. Newbigging, is evident by the fact that in the course of a reply to the discussion, he mentioned that the public did not know the value and the capabilities of gas as they should do, and that although gas investments were for a time depreciated in value, when electricity was just introduced, to-day there was not a sounder investment than gas securities in the market. These views suggest that instead of proposing drastic changes, involving extensive alterations in the distributing plant, it would be better to exercise more enterprise in the way of encouraging and facilitating the use of gas for lighting and heating. Owing to the advent of inverted incandescent gas burners and high pressure, the Manchester experience does not represent the average over the country, and many gas undertakings could show lighting percentages that would compare very favorably with those recorded by the Manchester Electricity Committee. 300 B. T. U. gas could no doubt be put into the holder at a cost of next to nothing, but the storage, distribution and installment expenses, in connection with a gas used chiefly for fuel purposes, could be greater, rather than less.

On this side of the Atlantic we are confessedly guilty of a slavish respect for established custom irrespective of merits, but I always thought—unfortunately my acquaintance with the States is second hand and not personal—that in America matters were decided on merit alone. But I notice that you still retain the established form of meter index, with its small dials and short stubby pointers. Why it should be the general rule to use an index involving alternate right and left hand reading, and figures upside down, or at various points of the compass, is not very obvious; or why the pointers should travel continuously, occasionally leading to doubt and dispute if they do not happen to register accurately with figures, when a ratchet motion, advancing one figure at a jump, would obviate uncertainty and facilitate correct reading by any person who can tell the time by a clock, is quite as simple in construction. Some years ago one meter maker adopted the plan usual in counting machines, of showing the figures on one straight line in separate circular holes, but the idea did not catch on, perhaps because at that time a very general impression existed amongst gas companies that the less consumers know about meters and meter indexes, the better. Or why should not the pointers be fixed upright and the dials revolve, which would admit of the index always being read off the same straight line? Recently I have seen a suggestion in the direction of photographic records of indices, and if this was adopted the indications could be taken on a reeled film, spaced and numbered to correspond with the rental book, cut off in page lengths, and gummed in place to correspond with the list of consumers, as shown by the following sample:

1.	Smith, J.,	1 North	street.	Mar. 31	1. 205,6
2.	Jones, W.,	2 "	"	"	2. 14,8
3.	Brown, T.,	3 "	"	"	out

The figures to the right of the dividing line represent those recorded by the photographic film.

In view of the cowardly and inhuman attacks that have been made upon helpless women and children by means of German Zeppelins—within a stone's throw of the place where I am now writing, there are houses laid in ruins notwithstanding the fact that the district is purely civilian and of no military importance—stronger measures are being introduced by the authorities in the matter of restricting all kinds of artificial light that may directly or indirectly cast a reflection upward. A new order from the Home Secretary forbids the use of illuminated sky signs, lettering or other advertising sign. The inside lighting of shops or factories is to be so shaded, or so reduced that nothing more than a very subdued reflection may be shown outside. The same applies to bright inside lights, and transparent glass roofs must either be shrouded or the lighting under them extinguished early in the evening. The lighting of wharves, quays, railway goods yards and stations must be reduced to the lowest margin compatible to considerations of safety to traffic, and the upper part of all outside lanterns must be obscured. If adjacent to a water frontage there must be no reflection on the water.

I have been accustomed to stroll around the principal thoroughfares of the city, once or twice in a year, for the purpose of observing the lighting, which may be considered to include the latest advances. This week the object was of a different character. The intention was to notice the methods by means of which the restricting orders were complied with, and the effects as regards business, traffic, etc. Evidently more people are staying indoors after dark, and the people prefer to do their shopping and visiting during the hours of daylight. There appears very little evidence of system or method, and nearly all devices used are of a punitive and temporary character, such as improvised shades, and covering the upper part of the window with an inside lining of blue tissue paper, partially lowering the blinds, etc. The upper parts of glass lanterns have received a coating of black or blue paint, and the brush streaks are easily discernible. There is a wide difference of opinion as to what is or is not a subdued reflection. While some establishments show no substantial reduction as compared with normal times, other are in darkness, with the exception of a few lights in the rear of the premises. Evidently there is need of some authorized pronouncement on the subject. In very few instances is it possible to read the names on street corners, or the notice boards on omnibuses, numbers of houses and other evidence of locality, and if it is as difficult for the Zeppelins to locate vantage points of attack, as for a Weltshire moonraker to find his way about the Metropolis after dark, the public buildings, barracks, etc., are fairly safe. At the conclusion of one of my perambulations, I

S, SAN FRANCISCO, SEPTEMBER 30, 1915

found myself stranded somewhere about 3 miles from my destination, in a level district, with cross roads at right angles, and had to appeal to the driver of a passing horse cab. He carefully helped me into the vehicle, with an easy jocularity that betrayed symptoms of having been there himself, and at the conclusion of the journey followed me up the steps and winked at the hall porter. Such are the ways of Londoners.

A modern addition to our periodical literature is a lively and sparkling weekly magazine called "Gas." which presents the topics of the day in a condensed form suited for the rapid assimilation of men, who in these times enjoy very few intervals of inaction throughout the day, other than those that may most appropriately be called "leisure moments." A few minutes ago I referred to being hide bound by custom, and the entire freedom and independence of any such prejudices in the editorial column of "Gas," stamps the inviduality of the writer on the minds of many gas engineers as clearly as if the articles were signed. Amongst other pertinent matters, "Gas" has directed attention to the unwieldy nature of our legal and official unit of gas measurement, 1,000 cubic feet, and proposed that a standard of 100 cubic feet would in many respects be preferable. There is nothing new under the sun, and I recall at least one attempt to introduce this innovation, which was made some 30 years ago. A few engineers adopted the use of the "Cental," as it was then termed, probably on account of the custom of labelling the 100 cubic feet dial on the meter index as "Cents." About the same time it was proposed that the letter "M" might be adopted as a practical abbreviation of indicating 1,000 cubic feet. These notions are deserving of more consideration than they have hitherto received, and that they have not done so is more on account of inertia than for any other reason. The only thing in favor of the 1,000 cubic feet unit, is that it enjoys undisputed sway in Acts of Parliament. The "Cental" is practically the unit used by the government meter inspectors, as they fill up their certificates in terms of percentage, i, e., that the meter has been tested and found to be * * * per cent. fast or slow as the case may be. In the gas works rental ledger, the meter readers book, and the account rendered to consumers, the 100 cubic feet is invariably the unit. No one thinks of posting or rendering a statement of account in even 1,000 cubic feet. An invoice for 272. C. at 5d. per C. is more readily understandable to the lay mind, than 27,200 cubic feet at 4s. 2d. per 1,000, Gas at 5d. per C. appeals to some minds as being cheaper than at 4s. 2d. per 1,000 cubic feet, the cash value of the unit being more evident than the bulk thus represented, and is certainly more convenient when the consumption of gas per hour or per day is to be indicated. We hear a great deal in these days about educating the gas consumer. He is not altogether a willing pupil, and one way of going to work is to simplify all accounts and details to the utmost practicable extent.

Asphalt in 1914.

Although there was a decrease in the marketed production of natural asphalt and of manufactured or oil asphalt derived from domestic sources in the United States in 1914, the decrease was more than offset by the gradually increased output, from American refineries,, of oil asphalt derived from crude petroleum imported from Mexico.

According to J. D. Northrop, of the U. S. Geological Survey, who attributes the decline in asphalt production from domestic sources chiefly to the increasing use of the product manufactured from Mexican oils, the output of natural asphalt in 1914 amounted to 77,588 short tons, valued at $630,623; the output of oil asphalt from domestic petroleum amounted to 360,683 short tons, valued at $3,016,969; and the output from American refineries of oil asphalt from Mexican petroleum amounted to 313,787 short tons, valued at $4,131,153. Compared with 1913, the output of natural asphalt in 1914 declined 16%, and that of domestic oil asphalt 17%, whereas the output of Mexican oil asphalt increased 174%.

Locally, in Texas and Utah, the output of certain varieties of naturally occurring asphalt, required for special purposes, showed a gratifying increase, In California a notable increase in the output of oil asphalt, derived wholly from domestic petroleum, resulted largely from an increase in the use of asphalt in highway and pavement construction in the State.

Asphaltic material and products to the value of $186,142 were imported for consumption during the calendar year. Exports during the same period amounted in value to $1,247,020, leaving a trade balance of $1,060,878 to be credited to the domestic asphalt industry.

Office Management.

Paper by C. N. STANNARD to the International Gas Congress.

Before entering into a discussion of the proper management of an office, a few words defining its purposes and reason for existence will probably aid, and make more clear what is to follow. In general business, the office is the place for the originating of orders, receiving information, classifying and distributing it, and digesting the reports received from the various departments. In our business, the display room and cashiers' desks are very often located in the same building with the general offices and are in charge of the office manager, and must be considered under the general title of the office management.

In this paper no attempt will be made to give detailed instruction for conducting an office. There are many expert office managers in the gas industry, and the only purpose is to direct attention to some minor points that are sometimes neglected.

In the past, in many cases, the management of the office has not received the same minute attention that has been given to the operating departments. As the business has grown the office force has been enlarged, but many inquiries show that very few of the companies have designed their office departments with an attempt at scientific organization. This does not mean that there is no system or order in the average gas office, but that scientific management has not been applied as generally as it has been in many other lines of business. It is self evident that as the office department is virtually the controlling and directing force of all other departments, its management is worthy of the most serious consideration. If an efficient office is desired, there must be an efficient office manager. A man to fill this position must be one of great tact, an organizer, and above all, one with a naturally systematic mind. It is not difficult to discover whether a man is systematic or not. Glance at his desk occasionally or ask him regarding some memoranda given him recently. If he has to empty all his pockets before locating it, there is justification for the suspicion that he is not orderly in his habits.

In addition to an able manager, charts of the organization will prove invaluable in saving of time and promoting smoothness of operation of various departments. These charts may be designed to show the relations of the various departments to each other, the duties of each department, names of heads of departments, the courses of orders and other information—in fact, a graphic representation of the organization. The preparation of these charts will many times show where time and energy are being lost and where improvement in the system in use may be made. If several of these charts are prepared and hung in convenient locations, there is no excuse for any one's not knowing whom to call upon in any contingency.

After the charts are prepared, it will naturally follow that, wherever possible, all members should have a description of their duties. If this has not been done for some time, the office manager may be surprised to find that some of the members of the department appear surprisingly busy considering the amount of work the written directions assign them. This method defines authority and prevents friction because of misunderstandings.

An office of any size must have a system of internal communication. The time of most office men is too valuable to be spent in traveling from one part of the office to another, and if this is done, the element of visiting enters, which is probably as prolific a time waster as any that ever entered an office. Most offices have either office boys, tube systems or both, for intercommunication purposes. If office boys are used, the number of boys may be diminished and better service obtained by having frequent regular trips made instead of haphazard calls when needed. Under the haphazard plan there are very often a dozen idle boys one moment, then none will be in evidence when needed for half an hour. Even with the trip system it is necessary to have boys available for special demands, but it is possible to use some of the older boys who have graduated to additional duties when special service is needed. Another advantage to an efficient messenger service is that it naturally tends to encourage written communications from one member of the department to another. Written communications have two advantages: First, very often they save time, as the note may be sent more quickly than the person to whom it is directed can be found and given verbal instructions; and second, a written instruction is a record that may be referred to at any time, and there can be no misunderstanding as to instructions given.

The number of people who must come to our offices every day makes the display room especially valuable. Numberless devices are resorted to by merchants in various lines of business to attract the public to their stores, and the gas industry is especially favored by

the circumstances that make it necessary for such a large number of persons to visit gas company offices each day.

On this account, the arrangement of the office is an important feature. The application desks, cashiers' windows and other points sought by the public should be so located that the various displays must be passed in order to reach these points, and thus the public induced to see the merchandise that is carried by the gas company.

In Denver the display room is considered so important that schemes are constantly devised to draw large crowds in addition to those who would visit the office anyway. Special demonstrations are carried on during the last three or four days of a discount period, and as there are three discount periods, for nearly half the month something special is going on at the office. A good deal of money is expended for fixtures and upkeep of the display room, and the volume of sales is increasing each year in spite of the fact that competition is much keener than a few years ago. A capable man spends most of his time working out window displays and arranging the displays on the office floor. Too much stress can not be laid on the value of display rooms.

Discipline is one of the most important factors in the control of an office, but it is of such a delicate and intangible nature set rules can not be formulated for obtaining this necessary adjunct. Just how far we should attempt to have our control over our employees extend is a delicate question. We are dealing with American citizens, and any attempt at paternalism is sure to be resented with resulting loss in efficiency. On the other hand, where even personal habits of employees have a detrimental effect on the work of the department, these conditions must be changed. The thing that must be guarded against, however, is personal prejudices blinding us to the real conditions. We must of necessity be broad minded, and keep before our minds constantly the fact that efficiency is what we are after. Personally, I do not believe in printed rules governing employees posted in conspicuous places. They lower the self respect of the employee and make him feel a servant instead of a partner. Servants, or those who feel themselves to be servants, do not, as a rule, give the most conscientious or intelligent service. There are many other and better ways than printed signs to make known the "policy of the house" concerning the conduct of employees. If other methods, such as straight-from-the-shoulder talks, will not bring about proper discipline, then signs will not, and the unruly members of the department must be replaced.

As stated in the beginning of this paper, the office is the place where reports are received, classified and distributed. A great deal of labor is involved in fulfilling this function. It seems almost superfluous to say that the labor required to analyse and classify these reports will be reduced to a minimum if standard forms are furnished in every case where they may be used. Of course, the fact is recognized that all forms cannot be identical, but the sequence of items may be the same and thus office labor be greatly facilitated. It has been found by actual test that clerks can do 50% more work on standard forms than on those different in sequence of items.

It may seem to some of you that the items mentioned in this paper are largely of the nature of an academic technical discussion of the theory of office management, but theory and practice, if the theory be properly applied, are one and the same thing. The trouble with theory is that only too often it is improperly applied and when failure results, theory is blamed.

During the past year, we have had a striking example of a theory that became a practice much to the benefit of those who accepted it. A stranger came to Denver and made a business of calling on the hotels and restaurants, attempting to interest them in an accounting system for their kitchens. His system, as he explained it, was so accurate and complete that not even a baked pototo or strip of bacon could get out of the kitchen without being accounted for. He was met everywhere with the argument that being an auditor and not a practical man, he had worked out a system that was fine in theory but impractical for use in a hotel kitchen. The system then in use checked the food as closely as it would ever be possible to do. Experienced hotel men told him that he was a nice young man and that they hoped he would do well, but he had better forget his system and take a steady job. Finally, however, he induced one of the largest hotels in the city to give him and his system a trial. After a month's trial, what had been declared a visionary theoretical dream became a possibility, and when a year's trial showed a saving of $15,000 in the kitchen of that hotel, this dream became a delightful reality to the management of the hotel.

This incident is mentioned briefly for the purpose of bringing home the fact that there is a possibility that we might apply more system and theory to office management and get better results at a less cost.

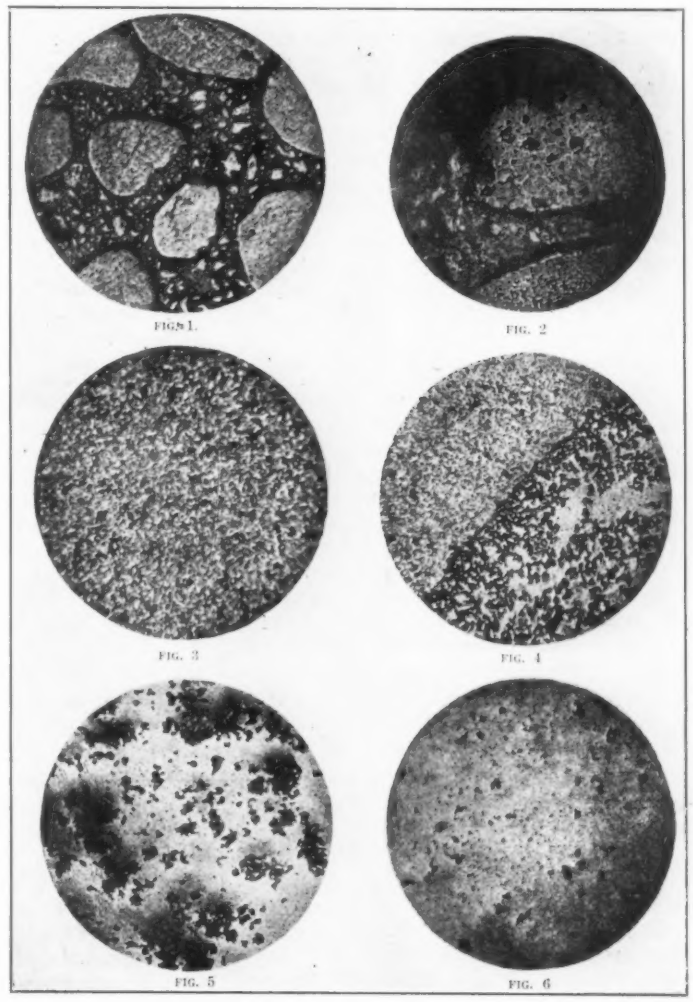
Incomplete Hydration of Cement.

WASTED CEMENT AND MEANS OF PREVENTION.

From Paper by N. C. JOHNSON to American Society of Mechanical Engineers.

It has long been suspected that cement in concrete is usually incompletely hydrated, because set cement could be reground and a new set obtained by gaging with water. Probably the first visual evidence of incomplete hydration was obtained by the author in the Sibley College laboratories, when thick, opaque, polished sections of cement mortar and concrets were studied under the metallographic microscope, using reflected light.

A microphotograph of a 1:3 mortar is shown in Fig. 1. The large areas are the grains of sand; the smaller areas between must be cement, because sand of only one size was used, and the color of these areas, with their behavior during polishing, shows that they are unhydrated. Much cement is thus unhydrated, and remains so even in old mortars. Fig. 2 is a section of a standard sand briquet magnified 200 diameters. The peculiar honeycomb structure is a patch of unhydrated cement.


FIGS 1. FIG. 2 FIG. 3 FIG. 4 FIG. 5 FIG. 6

Obviously cement unhydrated and inert is wasted, and if complete hydration could be obtained, the strength of mortar would be increased or the cement content could be cut down. A means of obtaining complete hydration would therefore be of great economic value, and experiments were made to find such a method.

The first experiments were attempts to develop apparatus giving more complete mechanical mixture; involving finely dividing the cement by a current of air, and discharging the cloud into a mist of water. Various machines were built, but all were incapable of commercial application, although their product was distinctly superior to ordinary mixtures. Further study revealed the underlying cause of incomplete hydration. Fig. 3 is a 30-diameter magnification of dry cement as it lies on the microscope slide. In Fig. 4, a film of water is seen advancing across the slide; the uniform distribution of the cement is destroyed and the particles tend to coalesce in groups, the effect of the surface tension of the water. The groups of particles form crystalline substances, with

the water on their edges and the interiors unhydrated and inert. Evidently the solution of the problem of obtaining complete hydration lies in breaking the surface tension of the water; and this can be accomplished. Fig. 5 shows cement aggregates formed by adding water. In Fig. 6 a small percentage of alcohol has decreased the surface tension of the water, and the aggregates are largely broken up. Alcohol would be unsuitable for commercial use, being expensive and requiring too much liquid to take care of evaporation. Other agents can be had, however, easy to use, even more efficient, and without harmful chemical action. Experiments indicate that with these concrete can be produced of greater density and strength than heretofore obtainable.

Conversion of Non-Coking Fuels.

"The Gas World," London, gives this account of an English patent granted for a process of coking non-coking coals:

If workable on a large scale, this is an invention of considerable importance to the coking industry, for the author claims to have solved the problem of converting a non-coking coal into its opposite. According to the complete specification, the invention has for its object to obtain, "especially from inferior carbonaceous materials, possessing little or even no coking properties," a good dense fuel of the quality of coke, and of any required hardness, and to enable the hardness of the coke to be regulated as desired. He claims that after careful researches he has ascertained why certain carbonaceous deposits have a coking property, whereas others do not coke at all, or only slightly. He found that all coking carbonaceous materials contain a certain admixture not found in non-coking carbonaceous deposits. Contrary to the accepted theory that the coking qualities of carbonaceous materials are due to natural resinous compounds formerly existing in the vegetable growths, he found that the reason for these qualities is the presence of certain mineral constituents which must be in a particular state of combination.

The specification continues:

"Clays are formed by the denudation of rocks and granites. Chemically, they are principally alluminium silicates, and are formed by the action of water on alkali-alumino silicates, the alkali silicate being dissolved out and leaving the insoluble aluminium silicate. Where a deposit of carbonaceous material has been brought into intimate contact with finely divided clay during the infiltration of water, assisted by great pressure through a long period of time, the clay or aluminium silicate in the carbonaceous material may be in some cases converted into a fusible slag of great binding power; when the carbonaceous material is heated in a coke oven, coke being thus formed. In other cases, however, although similar conditions apparently prevail, no coke is formed, and chemical examination of the two kinds of coal has shown that, although both contained the same elements, they were present in different states of combination."

The invention is based on the recognition that the coking qualities of carbonaceous materials are primarily due to the presence of compounds of aluminum and silica containing in chemical combination therewith alkalies, or alkaline earths, magnesium or iron, or such other metals as can take the place of and have the same effect in the combination as iron, in such quantities as to obtain the property of great permeability and comparitively low fusibility, and of keeping the particles of the coke formed bound together. The idea is, therefore, to artificially impart to non-coking materials the qualities naturally inherent in coking materials, by incorporaing with the former, prior to or during distillation, substances naturally found in the latter. These substances must be fusible, so as to thoroughly permeate the whole mass during distillation, and bind together the particles of coke formed. For this purpose natural or artificially prepared compounds of aluminum and silica, containing in chemical combination any or all of the above enumerated substances, have been found suitable. Among the natural materials, the following substances occasionally contain the particular compounds, and may be used as admixtures, namely, fireclay or ballclay, shale or red clay, gault, marl, or zeolites; while among suitable artificial materials are included a number of minerals formed by the action of the weather from felspars, such as kaolin, from potash felspar, or calcareous zeolites (chabasite, phillipsite, desmine), or those formed from soda felspar, such as analcime and natrolite.

As, however, it may not be easy to find a perfectly adapted natural mineral, it is preferable to treat the natural bodies in such a way as to increase their fusibility and binding power. For instance, when an infusible clay has to be used, it can be converted into a fusible compound by treating it in a furnace, or autoclave, with alkali or lime, whereby the respective compounds of alkali or lime, with alumina and silica, are formed. These compounds may then be treated in the furnace with a metallic compound, e. g., of iron, or a salt or compound of such other metal that can take the place of and have the same effect in the alumino-silicate compound as iron.

The density and hardness of the coke obtained will depend upon the proportion and the nature of the added material, and the degree of heat to which it is subjected. The exact choice of the admixture to be used with the best effect depends, naturally, on the constituents of the mineral ash of the non-coking carbonaceous material, which differ very largely in various coal fields, and which must be ascertained by analysis. According to this analysis, the selection of the binding substance is made in the manner above described. The carbonaceous material is powdered finely or coarsely as desired. If finely powdered, the material may be charged more compactly than in a coarse state. The binding material is then incorporated, either in a finely powdered dry state or with the aid of water. According to the desired hardness of the coke, a proportion of 3% to 8% of the admixture is used. The mixture is then subjected to distillation, the coke being formed from the carbonaceous residue by the cementing action of the fused admixture, which becomes liquid, permeates the whole mass, and combines with the mineral matter contained in the carbonaceous material.

Fireclay or ballclay sometimes contains, besides the special compounds of aluminium and silica in chemical combination with the substances above referred to, some quartz or fine silica; thus, in some cases, a considerable proportion of siliceous matter, which in the hydrated state has an acid reaction, is present. In such cases it may be advisable to add a calcareous clay, such as gault or marl, as well; or powdered granitic rock may be used for this purpose. Where, however, there is already a considerable proportion of basic matter, a siliceous clay, shale, loam, red, brown or black sand, ferrous, ferric or aluminium silicates, may be advantageously used in addition to the special compounds of aluminium and silica containing in chemical combination therewith any of the substances above referred to.

Although the use of sodium or potassium compounds may be an advantage for the purpose of forming an easily fusible binding material for the coked carbonaceous matter, there must be no uncombined soda or potash present which is capable of giving an alkaline reaction in water, such free alkali having a detrimental action on the siliceous material of the retort. When a shale or clay is used it may be found of advantage to use one which, in addition to having the requisite properties, also contains carbonaceous materials, especially shales or clays usually found close to coal measures, since these contain both combined and free alumina and silica, and iron in the free and combined state.

Accidents that Could have been Prevented.

[From reports of MR. J. B. DOUGLAS.]

A stillman fell down the stairs of a still because of the defective condition of his shoe sole, and was severely injured. Shoe soles that constitute a tripping hazard should not be worn.

An employee, while using gasoline, struck a match to light a cigarette. An explosion followed, and he sustained severe burns. Comment is unnecessary.

A laborer was helding a chisel while two other employees were striking it with sledges. One of the sledges flew off the handle and injured one man severely. The sledge should have been examined before using.

A workman threw a heavy piece of wire from the window of a purifier house, without first looking to see if anyone was in the way. It struck a man working in the yard 25 feet below and injured his head. It is necessary to exercise great care to prevent accidents of this kind. Being careful first would prevent them.

A rigger's helper stood on a pile of short lengths of 2" pipe while placing a clamp on a derrick guy. The pipes rolled, causing him to fall. The accident need not have occurred as there were other safe places for him to stand while doing the work.

A stair tread had been allowed to remain in a defective condition for some time. It caused a fitter's helper to fall and sustain injuries which disabled him for more than a month. An instance where an inspection and prompt repair would have saved trouble.

Retort Coke One-Third.

The Geological Survey's 1914 statistics on coke show the total output of the United States was 34,555,914 net tons, valued at $88,334,217. Of this 23,335,971 tons was made in beehive ovens, with an almost total loss of the by-products; and 11,219,943 tons, or 32.5%, was produced in by-product ovens, with a recovery of over $17,500,000 worth of by-products, or approximately $1.55 per ton of coke. As over 23,000,000 tons of beehive coke was made, and as the yield of coke is less in beehive ovens than in by-product ovens, the loss from coal made into coke in the beehive ovens in 1914 is put at not less than $40,000,000. The slump in copper and other base metal smelting following the declaration of war last August was responsible for a marked decrease in the coke production in the Rocky Mountain States.

Compared with 1913, the decrease in output was 11,743,616 tons, or 25%, in quantity, and $40,588,056, or 31.5%, in value The beehive and by-product coke did not suffer equally in the decrease, the former falling off 10,248,859 tons, or 30.5%, in quantity, and $30,030,371, or 37%, in value; as compared with a decrease in by-product coke of 1,494,757 tons, or 11.8%, in quantity, and $10,557,685, or 22%, in value.

Three States, Kentucky, Ohio and Washington, showed increases, all due to by-product plants begun in 1912 and 1913. At the end of 1914 there were 99,755 ovens in the United States, of which 5,809 were by-product ovens and 93,946 were beehive. Of the by-product ovens 667, or 11.5%, were idle throughout the year, and 44,450, or 47.3%, of the beehive ovens were idle. At the end of 1914 there were under construction 644 new by-product ovens and 605 new beehive ovens. In the year seventy-one by-product ovens were abandoned, all of which it is expected will be replaced by others of the retort or distillation type, and 3,603 beehive ovens were also abandoned.

The following table gives the output of coke in 1914 by States:

	Net tons.
Alabama	3,084,149
Colorado	666,083
Georgia	24,517
Illinois	1,425,168
Indiana	2,276,652
Kentucky	443,959
New Jersey	255,283
New Mexico	362,572
New York	457,370
Ohio	521,638
Pennsylvania	20,258,393
Tennessee	264,127
Virginia	780,984
Washington	84,923
West Virginia	1,427,962
Maryland, Massachusetts, Michigan, Minnesota, Utah, Wisconsin	2,222,134
Total	34,555,914

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by ROYAL E. BURNHAM, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,152,213. Gas Cock. R. M. G. Phillips, West Haven, Conn., assignor to The Sentinel Automatic Gas Appliance Co., same place.

1,152,338. Emergency Gas Cut-Off. G. R. Nixon, Pittsfield, Mass.

1,152,514. Gas Producer. E. A. W. Jefferies, Worcester, Mass., assignor to Morgan Construction Co., same place.

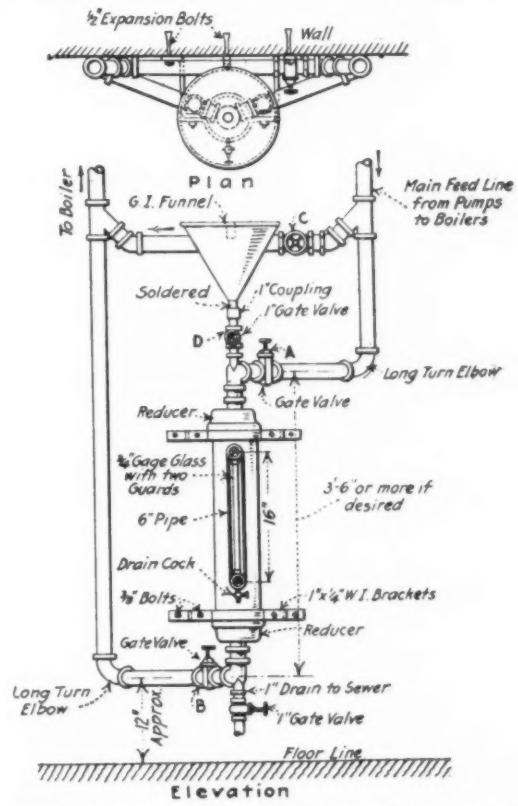
1,152,869. Manufacture of Water Gas. C. F. Zeek, Pensacola, Fla., assignor to The United Gas Improvement Co., Philadelphia, Pa.

1,153,235. Rotary Pump for Gas Producing Apparatus. C. S. McFarlane, Aukland, New Zealand.

1,153,417. Gas Generator. G. H. Bentley, Westminster, London, England, assignor of one-half to E. G. Appleby, London, England.

New Methods and Appliances.

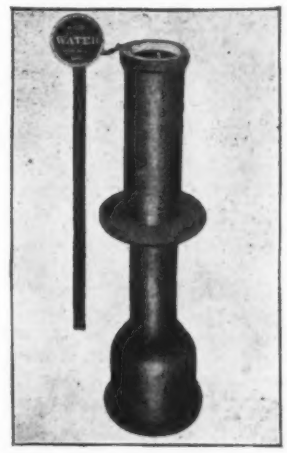
BOILER-COMPOUND INJECTOR MADE OF PIPE FITTINGS.—A device for injecting compounds into boilers that can be made of pipe fittings at a slight cost and which has proved satisfactory in operation, is shown in the accompanying illustration. The injector is installed in a by-pass, with the valves arranged as shown. The by-pass should be of the same size as the main feed line from the pumps, while the height and diameter of the chamber will vary with local conditions or the quantity of compound used at one time. Ordinarily a piece or 6″ pipe, 2 feet long, will suffice.



ASSEMBLED HOME-MADE BOILER-COMPOUND INJECTOR

To cut out the injector, valve *C* is opened, then valves *A* and *B* closed. The contents of the chamber is discharged by opening the valve on the 1″ drain. To fill the chamber with compound, the latter valve is closed and valve *D* is opened. The charge is injected into the boilers by closing valve *D*, opening valves *A* and *B*, and then closing valve *C*, in the order mentioned.

TELESCOPIC VALVE BOX.—A valve box brought out very recently is of a sliding telescopic instead of the familiar screw type, and is so made that the upper section has no bearing upon the lower section. This prevents a heavy load on the top of the box from being transmitted to the valve or the main, and so causing leaks or breaks.



A bonnet on the lower section holds the valve in position within it, and will fit valves of 4″ to 12″ size. The upper section has a broad flange to take the vertical load due to vehicles, etc., and is fitted with a locking lid, attached by a chain so that it cannot be lost.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Meriden (Conn.) Gas Light Company has started laying concrete foundations for the new White Way poles that are to be installed. The work is being started on West Main street, and some of the lights will be in use before the year ends.

THE steel companies of the United States are producing about 15,000,000 gallons of benzol per year, compared with 3,000,000 gallons before the war, according to I. F. Stone, president National Aniline and Chemical Company. He says that the demand for this product for war purposes is so great that the increase is inadequate, and prices are so high that those who use benzol for ordinary manufacturing purposes are seriously inconvenienced. Predictions of still larger increases in the production are made, so that the German domination of the past would be no more heard of. The partial substitution of benzol for gasoline in automobile propulsion he predicted as certain, because the price would fall ultimately to a level with gasoline.

THE Gas Appliance Company of Superior, Wis., has installed the gas piping to furnish gas to the domestic science department and the several laboratories in the new school building. This firm also provided the domestic science equipment, consisting of cooking tables, cabinets and 12 double gas stoves and ovens, which is the most modern equipment of its kind in the northwest.

THE La Salle, Ills., "Tribune" says: "Engineers from the State Public Utilities Commission have completed an exhaustive investigation of gas and electric conditions in La Salle and Peru, Ills., and have gathered a vast array of data which they will present to the commission for consideration. The engineers were called to La Salle following the receipt of complaints by the mayor and council as to the quality of the product being supplied to consumers in the city."

HERE'S good advertising: "The first meeting of the Household Economic Department of the New Haven, Conn., Woman's Club was held in the assembly room of the gas light company, Mr. Herbert D. Deetz, general secretary of the New Haven County League and Farm Bureau, was the speaker, having chosen for his subject, "Conservation of Rural New England Life." There was also demonstrations of canning fruits and vegetables of Simmons College. The program was a most interesting one.

THE proposals by the Consolidated Gas and Electric Company and the Merchants Power Company of Memphis, Tenn., to reduce rates on power and illuminating current for a period of years in lieu of a municipally owned and operated lighting plant are not looked upon with favor by the city. While municipal officials are reticent about discussing the proposition, indications are that because of a certain clause in the contract-ordinance under which the two companies are operating, the proposal will be rejected.

DR. HARVEY GILBERT, official reader of the gas photometer for Bay City, Mich., reported for the week ending October 10th as follows: October 4, 17.27 c. p., 595 B. T. U.'s; October 5, 18.7 c. p., 588 B. T. U.'s; October 6, 17 c. p., 566 B. T. U.'s; October 7, 19.2 c. p., 607 B. T. U.'s; October 7, 18.67 c. p.; October 8, 19.3 c. p., 608 B. T. U.'s; October 8, 16 c. p., 587 B. T. U.'s; October 9, 16.35 c. p., 576 B. T. U.'s; October 10, 17.87 c. p., 587 B. T. U.'s. Average candle power, 18.06; average B. T. U.'s, 590.

THE Consolidated Gas Company, New York city, is reported to be the buyer of the old edifice of the Central Presbyterian Church, at 212 to 218 West Fifty-seventh street, which it will remodel for a division office and display room.

THE Brockton (Mass.) Gas Company is making rapid progress in putting gas mains in Stoughton. A local reporter says: "The process of laying and welding the pipes is an interesting one and is being done in a very thorough and substantial manner."

ACCORDING to our Consul at Amsterdam, the gas works at Akkrum, in the Province of Friesland, is making gas from a mixture of peat and coal. It is said that if peat alone is used, the retorts become too hot, because of the steam from the moisture in the peat. The retorts are charged with two parts by weight of coal and one part peat. All coal, and especially gas coal, is at present very scarce in Holland, as it has to be imported from a great distance at a heavy cost.

AT the annual meeting of the South Shore Gas Company at Babylon, N. Y., the following officers were chosen: President, M. P. Cutter; Vice-President, G. W. Olmstead; Treasurer, E. L. Phillips; Secretary, H. R. Frost. No dividends were declared. These will be announced later, it is said.

CIRCUIT JUDGE YUNGBLUT, of Newport, Ky., has entered an order enjoining Captain George Armstrong, or other Government authorities, at Ft. Thomas from interfering with gas mains laid on Ft. Thomas avenue, in the city of Fort Thomas. Captain Armstrong claimed that the deeds ceeding the Government reservation gives the boundary line as the center of the street. The suit is an outcome of the recent clash at Ft. Thomas between the military authorities and the city officials regarding the laying of pipe along Ft. Thomas avenue.

SUPT. J. H. DAWES, of the Iron Mountain (Mich.) Light and Fuel Company, has made an appraisal of the property of the Antigo (Wis.) Gas Company. He was called to do this work by W. G. Maxey, receiver for the Antigo plant, and will appear as a witness in court proceedings relative to a transfer of the property.

THE Sault Ste Marie (Mich.) Gas and Electric Company has purchased a calorimeter for the purpose of verifying gas tests made by the city. When the matter of the quality of gas furnished by the company came before the council several weeks ago, two chemists made tests of the gas and the tests varied considerably.

A RECEIVER of the Auburn (Wash.) Gas Company, alleged to be insolvent, is asked in a suit filed in the Supreme Court by Bailey Tremper, who also asks judgment for $1,862.34, representing wages due a number of employees. Harlow W. Whiteside, manager of the company; Guy Dickinson, Oliver Morris, J. M. Reiter, J. L. Veach, A. M. Glenn, Robert W. Whiteside and Jessie Wilkirson have assigned their claims for wages to Mr. Tremper, according to the complaint. The complaint charges that the company has been unable to pay its creditors for the last 3 months.

AFTER a three months' trial of the co-operative agreement between the Gardner' Mass., Business Men's Association and Gardner Gas Light and Fuel Company, Manager A. A. Laughton, of the gas company, says that the prospects of rebating $1,000 to consumers at the expiration of the term of agreement is none too encouraging, as there are no indications that the company's business at the end of the year's agreement will show a sufficient surplus to warrant the rebate. He said: "As a result of our agreement with the Business Men's Association, our business has increased. We have probably added 200 customers to our lists, but it is doubtful if our business will show the net gain that the proposed rebate is based on. Now that business is picking up, a change for the better may be brought about, and there is no question that in time the small consumers will develop. In spite of the fact that present conditions indicate that the rebate cannot be granted, we have by no means given up trying to devise means to develop business so that the year's business will show a substantial net surplus. We intend to consult the directors of the Business Men's Association to see if something can be worked out to help the thing along. We are merely at a standstill trying to determine what new and economical plan will enable us to get the increase that we hoped to make. Regardless of the present outlook, the 5-cent reduction in the price of gas will go into effect January 1, as we agreed with the Merchants' Association.

THE increased demand for gas by the manufacturing concerns of the southeast end district of Rockford, Ill., will be met by the Rockford Gas Light and Coke Company, which plans several thousand feet of new mains to supply this thriving section. The new main extensions include a mile of 8" pipe from Charles street south on Twelfth street and then southeast. The work will be rushed, and when finished, will complete a huge belt around the city.

A SPECIAL window display week is planned by the Northampton (Mass.) Board of Trade. The merchants favor such a plan to be carried out the first of December, the object being to show what Northampton merchants could do toward Christmas shopping. There was a feeling that special effort in this direction would be a great help. Speaking on the value of window display, C. B. Day said that the Northampton Gas Company had accumulated 600,000 pounds of coke and could not sell it. He placed in his front window a new bushel basket filled with coke and another basket of the same size having less than a hod of coal. Above was a card saying: "Each of these for 12 cents." The result was that the coke was sold in a week's time.

AT the annual meeting of the Danielson and Plainfield (Conn.) Gas and Electric Company the following directors were elected: J. W. Dobbie, H. S. Shaw, N. T. Hurlbut, A. E. Shaw, all of Webster, and Nathan D. Prince, Danielson. At a subsequent meeting of the directors the following officers were elected: President, J. W. Dobbie; vice-president, H. S. Shaw; general manager, H. S. Shaw; treasurer, Nathan D. Prince.

THE voters of Lake Charles, La., have ratified the gas franchise awarded to J. G. Boyle and J. C. Fessler. Within a year the owners of the franchise must have their plant in operation, or forfeit the bond of $10,000 furnished by them the day the franchise was awarded by the city commissioners, and it is more than likely that gas will be flowing through the mains early in the spring or summer. While the owners of the franchise have not closed any deal for a site for the plant, several good locations are available. J. G. Boyle is expected to arrive shortly in Lake Charles, when arrangements will be made for the purchase of a site and construction of a plant.

ANNOUNCEMENT is made that Charles Edward Fincke, a member of the firm of Fincke, Bangert & Co., investment bankers, of Philadelphia, had been elected president of the Girardville Gas Company, of Girardville, Pa. The company controls a group of plants supplying the following points in Eastern Pennsylvania: Girardville, Frackville, Mahoney Plane, Gilberton, Coaldale, Summit Hill, Lansford, St. Clair, New Philadelphia and Palo Alto.

THE electric street lights of Great Neck, N. Y., have been discontinued, and for five years the community will be lighted by gas. The contract for lights was recently awarded to the Public Service Corporation of Long Island, over the Nassau Light and Power Company. There are 286 gas lights in the district.

FOR the 'steenth time in four months the foreclosure sale of the Dover, Rockaway & Port Oram (N.J.) Gas Co. has been postponed. Addison Ely, representing the stockholders, presented a series of written objections to selling the property, claiming that the order of Chancellor Walker, ordering the sale postponed, had not been carried out to the letter, in that no advertisement had been published of the adjournment. The advertisement published in two local papers, he said, was not sufficient to protect the holders of the equity. The company, he said, was worth $300,000. Francis Lafferty, representing the Fidelity Trust Company, of Newark, bondholders and plaintiffs in the foreclosure, objected to Mr. Ely's request for postponement, on the ground that it might jeopardize the proceedings. After a call for bids, with no response, however, Mr. Lafferty consented to a postponement for two weeks, the postponement to be by proclamation and not by advertisement.

AT a special meeting of the Selectmen, October 21, a franchise was granted to Edward F. Draper, of Boston, Clarence E. Barnes, of Mansfield, and C. A. Day, of Dedham, to construct and operate a gas plant in Needham, Mass. The organization will be called the Needham Gas Company, and will probably be capitalized for $100,000. The company will be required to give bonds of $5,000 to insure that the streets will be left in proper condition after the laying of the gas mains. A bond of $10,000 will also be required to protect the town against liability for accidents to persons or property during construction work. The franchise names Dec. 1, 1916, as the date for the completion of the work and for the company to begin business. A bond will be required to insure that this provision of the franchise is complied with. The initial installation will comprise not less than 8 miles of distribution mains. The company has until January 1, 1916, to accept or decline the franchise.

UTILITIES COMMISSION NEWS.

A NEW YORK RATE INCREASE.—The Public Service Commission, Second District, New York, has permitted the Lockport Light, Heat and Power Company to increase its rates, on its showing that it was not earning a fair return on the capital employed in the public service. The claim that the company was not earning a sufficient return was not contested, and the case presented a very favorable situation for a rate investigation by the commission as the company's affairs have been the subject of frequent reports and examinations in recent years, the last during the current year with regard to certain allocations of fixed capital.

An agreement was reached between the City of Lockport and the company's representatives during the hearings that the actual fixed capital of the company employed in the business was $467,435.66, not including working capital and certain intangibles which the company claimed should be charged against a reproduction cost. These sums amounted to another $170,000, but Commissioner Carr points out that it was not necessary to go into this contested field, as even on the "bare bones" valuation of $467,435.66 the shareholders could get but a little over 2% on their investments.

"It should be borne in mind," says Commissioner Carr's opinion, "that the company is entitled to a working capital of at least $25,000, upon which it is also entitled to earn a fair return. Assuming that the company is entitled to earn a return of 7% upon a valuation of $492,000, which figure includes the above mentioned sum for working capital, its income available for interest and dividends should be $34,435 per annum. It must also earn an additional $9,223 per year to take care of the increased cost of power. * * *

"Since the hearing in July, 1915, the engineers of the company, the city and the Commission have been actively at work in an attempt to work out a schedule of rates that would be fair to the city of Lockport as well as the company, and it is believed they have succeeded. It appears from the record that the rates in the city are as low, or lower, than in the nearby cities; in fact, some of the rates are much lower than the company is warranted in giving. This is particularly true of the commercial power and the wholesale power rates, and it is these that ought to be advanced to give the company a fair return for its service. Some increases are also justified in the rates for residences and for commercial lighting. A schedule has been worked out which will enable the company to earn $41,667 per annum, if it is able to retain all its present customers; if it loses any of them it will not increase its earnings to that extent unless the remaining customers give the company more business, or it obtains new customers to make up for those who cease to use its service. The fact that the engineers of both parties, as well as the engineers of the Commission, agree that the schedule of rates proposed is fair, makes the Commission feel justified in ordering it into effect as of November 1, 1915, and to continue for a period of 3 years thereafter, unless sooner changed or modified by order of the Commission."

The case was a notable one, in that all parties agreed as to the necessity for the increase and all the engineers agreed as to the justice of the scale worked out.

ALLOWS COMPETING MUNICIPAL PLANT.—The Appellate Division of the Supreme Court of New York, sitting recently in Saratoga, heard arguments in certiorari proceedings instituted by the Bath Electric Light and Gas Company, for a review of the evidence given before the Public Utilities Commission at the time when that body granted a certificate of necessity and franchise to the Bath Municipal Electric Light Company.

The decision just rendered, sustains the action of the Public Service Commission in granting a franchise to the municipal company. After the Utilities Commission had granted a franchise to the municipal company to build and operate its plant in competition with the Bath Electric Light and Gas Company, the established and private company, the latter concern appealed to the Appellate Division to review the action of the commission, alleging certain irregularities. In the meantime a temporary injunction was granted restraining the municipal company from making contracts for service with private concerns; however, the municipal company has maintained its street lighting service since July last. Unless some other legal obstacle intervenes, the municipal company will now proceed to contract with private concerns for light and power service.

Financial Notes.

THE annual report of the MASSACHUSETTS GAS COMPANIES for the year ended June 30, 1915, has been issued. The income accounting compares with those of the two previous years as follows:

	1915.	1914.	1913.
Interest received	$426,201	$449,335	$420.907
Divs. received	2,404,895	2,368,025	2,386,318
Profit on sale of securities	3,637	1,207	750
Total earnings	$2,834,733	$2,818,567	$2,807,975
General expenses	93,214	88,218	66,388
Int. on bonds and notes	454,927	441,767	440,018
Dividend on pref. shares	1,000,000	1,000,000	1,000,000
Res. for dep. of securities	3,637	1,207	.....
Total	$1,551,770	$1,531,192	$1,506,406
Surplus for year	1,282,954	$1,287,375	$1,301,568

The undivided earnings of the subsidiaries of the Massachusetts Gas Companies compare as follows:

	1915.	1914.	1913.
Boston Consolidated Gas	$146,179	$53,090	$62,068
East Boston Gas	3,163	3,311	8,452
N. E. Gas and Coke	4,132	10,254	2,427
Citizens (Quincy)	1,732	3,347	3,569
N. E. Coal and Goke	1,453	14,789	102,663
Newton and Watertown	4,161	*1,541	11,891
Federal Coal and Coke	34,336	19,094	22,374
Boston Tow Boat	208	1,431	3,036
Net surplus	$195,367	$103,775	$216,383

* Deficit.

President C. Minot Weld, in his remarks to stockholders; says, in part: "During the year ending June 30, 1915, the trustees voted to set aside $1,250,000 from the accumulated earnings for the payment of dividends upon the common shares in the year ending June 30, 1916, same being at the rate of 5% per annum. The reduced price at which gas was sold during the year by the constituent companies, when compared with the price charged at the time our trustees acquired control of these companies, represents a saving to the consumers (and subsequent reduction in earnings) for the year ending June 30, 1915, as follows:

Boston Consolidated Gas Company	$1,044,131
East Boston Gas Company	165,949
Newton and Watertown Gas Light Co.	54,565
Citizens Gas Light Co. of Quincy	100,993
	$1,363,639

The following trustees were elected to serve for 2 years: Charles F. Adams, 2nd, Walter C. Bayies, Samuel Carr, J. B. Russell and Robert C. Pruyn. Total shares voting were 150,561 common and 136,180 preferred.

N. W. HALSEY & Co. have purchased $750,000 Laclede Gas Light 5% debentures, due Feb. 1, 1919, and resold practically the entire amount to investors at 99¼. A previous issue of $2,500,000 was marketed last year by the same bond house.

WASHINGTON (D. C.) GAS LIGHT COMPANY has declared a quarterly dividend of $1.20 per share, payable November 1.

PRESIDENT H. M. BYLLESBY has sent a letter to shareholders of the Standard Gas and Electric Company announcing that the time for receiving subscriptions to the company's new 6% gold note issue has been extended to November 15.

THE Mercantile Trust Company is exchanging the new first and refunding mortgage bonds of the Midway Gas Company for the former securities in conformity with the plan of reorganization recently approved by the Railroad Commission. The new bonds comprise an issue of $1,450,000, and each of them, delivered to depositors, will have the June 1, 1915, coupon attached. This marks the final clearing up of the Midway gas situation.

COUNSELMAN & Co. are offering $1,500,000 Memphis Street Railway Company two year 6% collateral notes to yield the investor 6¼%. The Memphis Street Railway is a part of the UNITED GAS AND ELECTRIC CORPORATION. The notes are secured by $1,416,000 first mortgage bonds and $492,000 general mortgage bonds. Earnings are equal to about two and three-fourth times the earnings on the notes.

DENVER (Col.) GAS AND ELECTRIC LIGHT COMPANY reports earnings for the twelve months ended Aug. 31, showing an increase of almost $50,000 in gross, and a decrease of nearly $150,000 in operating expenses, maintenance and taxes, resulting in an increase in net of slightly less than $200,000. The comparative statement for the twelve months ended Aug. 31, 1914 and 1915, follows:

	1915.	19 4.
Gross earnings	$3,218,820	$3,169,789
Operating expenses, maintenance and taxes	1,616,776	1,765,597
Net earnings	$1,602,044	$1,404,192
Interest	380,515	380,515
Balance	$1,221,529	$1,023,677

THE Board of Directors of the PACIFIC GAS AND ELECTRIC COMPANY have declared the regular quarterly dividend to Oct. 31 of $1.50 per share, upon the full paid first preferred and original preferred capital stock, payable November 15 to holders of record October 30.

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